TECHNICAL REPORT
68-2-FL

STUDY OF COMPUTER PROCEDURES FOR MENU PLANNING AND RECIPE SERVICE FOR DoD ELEMENTS

by

Roger T. Baust

Adams Associates Incorporated
Bedford, Massachusetts

Contract No. DAAG 17-67-C-0131

July 1967

UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760

Food Laboratory
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FOREWORD

This task was carried out to comply with the objective in Memorandum for Assistant Secretary of the Army, 16 January 1967: "a survey of the present status of computerized menu planning accomplishments and research. Review of computer applications in Army, Navy, Air Force and Marine Corps, Veterans Administration, Department of Agriculture, and civilian and university hospitals which have a bearing on food service control."

The study consisted of two parts:

A Conference on Computer Procedures for Menu Planning and Recipe Service for DoD Elements, held 4 and 5 April 1967 at U. S. Army Natick Laboratories. In attendance were representatives of the Food Service Organizations of all DoD elements, of military, Public Health Service and Veterans Administration hospitals and from universities. Accomplishments and research plans were presented in formal papers and requirements for an eventual computerized system for food service were developed in working sessions.

A review of the Conference and of the technical literature was performed, under Contract No. DAAG 17-67-C-0131, by Adams Associates, Inc., to model a computerized system for menu planning and recipe service, to determine the compatability of accomplishments with the modeled system, and to discover gaps in knowledge and technology which might impede development of the system.

The Proceedings of the Conference and the Review are presented in the following report prepared by Adams Associates, Inc.

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ABSTRACT

A survey of present status of computerized menu planning accomplishments and research showed that no computerized menu planning system now exists in any military service, and there are no present plans to develop one.

The U. S. Navy and Marine Corps have no accomplishments in computerization of food service which would have a bearing on the development of a system.

Both U. S. Army and Air Force accomplishments are in the area of Food Plan recapitulation and nutrient content and costing verification. These are fully compatible with the system model proposed.

The Food Service Division, Walter Reed General Hospital, is conducting research on a comprehensive food service system of which menu planning is a minor and final part. Although specific for hospital use, parts of the system may be useful for a general troop feeding system.

The Veterans administration computerized procedure, which develops a 28-day Food Plan from which dietitians manually construct menus, may provide guidance for a DoD system.

Accomplishments and research in university hospitals are not directly applicable to military feeding. They are directed toward a demand-based stochastic system, whereas the military services use a plan-based deterministic system.

The Food Plan precedes and is more important than the menu. The Food Plan changes relatively slowly, and much of the clerical routine is now computerized. A model food service system has been presented which includes a Planning subsystem and a Service subsystem and which interfaces with a Supply system. Implementation of this system would result in a "Continuous Food Plan" which could materially shorten lead time in the present food cycle. Optimization of the Planning subsystem requires research to codify and evaluate color, texture and preference factors and the combinatorial effects of these with other factors; evaluate frequency limit restraints; investigate mathematical models which may be better than linear programming; and develop improved computer "learning models" to capitalize on man-machine interactions.

I. INTRODUCTION

A food service system to be used for the mass feeding of the military is multi-faceted and will appear totally different to a variety of people. The consumer sitting at a table in a mess hall will have one view of the system, whereas the cook will have another. The group doing procurement has its own problems and will have an entirely different view of the overall problem, while the dietician preparing the menus will see still another phase of it. Over this wide range of people quite a variety of viewpoints will emerge and no single one can be selected as being correct.

In any given case, the proper viewpoint for a system will depend on the particular purpose intended. However, whichever viewpoint is selected, the others must be taken into consideration whenever the interfaces between the various people involved are to be considered. For example, a dietician need not have the same viewpoint as the ultimate consumer, but due to the various interactions, must be aware of his reaction.

This study is concerned with evaluating the on-going research in the area of menu planning as it pertains to mass feeding of the Armed Forces. The study is also concerned with determining any technological gaps which may exist and could hamper the development of an integrated food service system.

Therefore, for purposes of this study, a viewpoint taken will be that of a systems analyst looking at the overall system, but particularly concerned with the applications of menu planning. The entire system of food service must be examined, otherwise, the perspective may be lost. On the other hand, the study must concentrate on the menu-planning aspects since it is the techniques and procedures that have been developed in this area that are of particular concern.

The overall system can be described as including a number of separate phases, beginning with the formation of a food plan. Prior to the preparation of the food plan, much work is required to establish ingredients, recipes, criteria, and so forth, but much of this can be classified as research. Following the food plan is the menu-planning phase and a combination of procurement and logistics involving the purchase of the food, its movement and storage. The next and final step in the overall system is production, or the final preparation and serving of the food. Each of these phases could be subdivided into a number of sub-phases, and this will be done in some areas of interest; but for those where the details are not under consideration, further divisions will not be made.

The food plan is a list of all items to be procured along with the quantities per standard unit of personnel and the times at which the quantities are required. Preparation of the food plan is a critical and complicated procedure and involves the use of a large mass of information available from a number of sources. Information on the characteristics of the food, the availability of recipes, the preferences for the individual recipes and the availability of the ingredients must be used in preparation of the food plan. These various inputs will come from a great number of sources and must all be taken into consideration at this planning stage.

The procurement logistics and inventory management phases can be quite complex and have many close interactions with the remainder of the system. However, since for the purpose of the study this collection of activities will be considered a "black box," the interior workings of it will not be detailed. The various interfaces, both forward and in a feedback form, will be considered as well as the specifications of the various inputs to this phase and the outputs from it. In a complete detailed systems analysis of the problem, the "black box" would have to be opened so that a closer integration could be evaluated as to its desirability.

Menu-planning consists of the establishment of combinations of recipes to produce the menus for meals, days, and sequences of days, based on available ingredients. This most critical function takes into account such factors as availability of foods, nutrient factors, preferences, physical characteristics, and inter-action between foods. In the more general sense, the length of the sequence to be considered in the preparation of a menu, e.g., whether it be for a day or for a month, may prove to be somewhat immaterial.

Menus will be prepared prior to the production level, either for use of a rigid plan to follow, or as a guide to assist the food service people. At the local level, menu planning will occur when substitutions must be made or expected ingredients are not available. It can be readily seen that menu-planning will occur in many different areas of the overall system.

Production could also be referred to as "local management" and includes the administration of food service on the local level. For purposes of this study, the local level is considered to be the lowest production facility, such as a mess hall on a base or a mess hall on a ship, or, depending on the method of operation, the base or the ship itself. It is assumed that at this level there is a certain amount of inventory maintained, and the ability, in certain special cases at least, to locally procure certain foods. The specific details of any inventory management system available at the local level were not considered pertinent, though it is recognized that they would have to be interfaced.

This study will not be concerned with the problems of selection of ingredients, or the preparation or analysis of recipes. Nor will it be concerned with the various techniques available for forecasting manpower loading, or distribution problems, or availability of foods. However, when forecasting would provide feedback or information required, the necessary techniques will be considered as existing or available. The study is not concerned with the various research techniques required to determine such characteristics as caloric content or nutritionalized bits of foods, but it is concerned with these values when they are serving as input to other stages of the system.

Other areas which are of direct interest are the internal workings of procurement, warehousing, transportation, and so forth. Again, these systems will be interfaced with, though the mechanics or internal workings or procedures will not be considered.

One category which is not of concern is the procedures for the local production facilities. Again, this is a matter of interfacing rather than integrating, and is not considered a proper subject for this study.

To review what has been said previously, this study is concerned with the overall problem of food service and with particular applications of menu-planning. It is <u>not expected</u> that a system will be designed, but rather that an analysis be made of what is currently happening in this field and how it may apply to the overall problem of mass feeding.

II. SYNOPSIS AND ANALYSIS OF ON-GOING DEVELOPMENTS

A. Non-Military

Most of the information available on computer-assisted menu-planning points to the efforts of four universities: Tulane University, University of Florida, Carnegie Institute of Technology and Ohio State University. Of these, only Ohio State was represented at the Symposium in the person of Professor John Casbergue. Ohio State is also the only one of the above to have not developed its own facility. Instead, it is using the facility at Tulane via an on-line remote data link. The emphasis at Ohio State is on teaching rather than on development. The other efforts have primarily been directed towards the application of computers to menu-planning using state-of-the-art mathematical techniques.

At Tulane University, Dr. Balintfy's efforts have been directed at developing a mathematical technique for solving zero-one integer programming models. Using recipes as the basic variables, Dr. Balintfy's model develops actual menus over a period of time using nutrient, texture, color, preference, and structural requirements, while optimizing or minimizing raw food costs. This differs drastically from the standard "Diet Problem" in that the model recognizes the structural requirements of institutional menus, forcing the mathematical technique to select, in combination, one item for each of a fixed number of menu classes or groups. Dr. Balintfy admits however, that maximization of personal preferences rather than raw food costs, using the food costs as a budgetary constraint would yield more palatable menus and should be considered a more realistic approach. Because "... for relatively simple conditions the menu problem poses excessive computational work on computers with standard mathematical programming codes," Dr. Balintfy developed a special integer programming structure incorporating a partitioned constraint matrix which produces efficient and yet quite acceptable results. This modified integer programming algorithm will yield optimal or near-optimal solutions, whereas other techniques involving zero-one integer programming models have been developed which will converge on an optimal solution (Balas). However, Balintfy's experiments indicate that the sacrifice of accuracy for the sake of efficiency does not seriously affect the results. An important extension of the mathematical synthesis of computer-assisted menu planning is the option of on-line adjustments made by a human dietician. The need for this option comes from the inability of his model to incorporate some of the subtleties of "such an irrational and sensitive human trait as taste...". Although effort has been expended to minimize the need for this form of adjustment, Balintfy visualizes a joint man-machine decision-making activity.

Considerable effort by the researchers at Tulane is developing the model had the indirect result of forcing the dieticians involved to take a long, hard look at their own operations. One outcome of this was the realization that the computerized menu-planning function must include the ability to retrieve the data base in a variety of formats and selection criteria, e.g., in order of decreasing cost, nutritional value or preference, to aid the dietician in choosing among alternatives.

Some work has been done evaluating Balintfy's model used as the basis of an interactive system with manual methods. Since it is not necessarily true that preferences for individual menu items are additive, the preference rating for a menu could only be judged by human evaluation. For this reason, the results were judged for overall acceptability by a panel of experts. The differences in preferences were found to be statistically significant although some variability was in evidence. From this it can be assumed that computer-assisted menu-planning is capable of producing menus that are acceptable to the consumer. Furthermore, the computer-assisted menus were 18% less costly than those prepared manually.

Results showed however, that computer-assisted menu-planning will require development of reliable quantitative measures of overall menu acceptability before computer-assisted menu-planning can be expected to exceed the acceptability of manually prepared ones. Moreover, the study showed that the type of computer interface (menu presentation and adjustment facilities) had a significant effect on the performance characteristics of the menu-planning. It showed that dieticians using the on-line interactive system made more economical adjustments of the original computer solution than did those using a totally off-line system. Finally, it was noted that as dieticians became more familiar with the computer, they tended to make fewer changes in the initial solution. Since optimization tends to decrease as the number of changes increases, familiarity with the system will lead to increasingly more optimized results.

The future of such a computerized model is seen as being included into larger inventory control systems where already-stocked items could be used to advantage and its inclusion would provide a fast turn-over of supplies with greatly reduced inventories. Expansion of this model for large-scale nation-wide use has the problem of standardization of menus due to regional taste differences.

At the University of Florida, Dr. Ronald L. Gue has expanded and redefined Dr. Balintfy's model to consider selective menu-planning. Specifically, Dr. Gue is investigating whether the methods used in non-selective menu-planning by Dr. Balintfy are applicable for use in selective menu-planning. Using Dr. Balintfy's integer programming approach which incorporates the structural requirements of institutional menus, selective menus are prepared with three goals:

1. The consumer must obtain the daily required nutrient amounts.

2. The consumer is allowed a choice of items within each menu item class (group).

3. The recipes selected must provide a reasonable degree of variety at each meal and from day to day.

Thus selective menus differ from their non-selective counterparts in that the consumer is provided with a selection of items within each class. Moreover, the optimization is stochastic in that all variables are treated as random variables and the probability of selection is based on selection frequencies gathered in operation. If one assumes that the selection of items from each menu class is independent of one another, the central limit theorem can be used in formulating mathematical constraints. In many cases however, selections from different classes are not independent, in which case the central limit theorem does not strictly apply, although ignoring this dependence for the sake of efficiency does not affect the overall results. This stochastic integer programming model attempts to satisfy the nutrient constraints on inferences about probable selection on the basis of past selection. In experimental analysis, some combinations of items from each class fail to fulfill one or more of the nutrient constraints, however, the probability of their selection was on the order of 10^{-3}, an insignificant amount.

The inclusion of minimum and maximum intervals between repetitions of a given menu item causes a sequential dependency upon daily menu plans over a period of time. Planning a sequence of daily menus individually over a period of days is not equivalent to planning the entire menu cycle at the same time. In fact, planning daily menus individually can be considered sub-optimization. This consideration has never been formulated as part of the mathematical model, but only artificially introduced into the model by monitoring the entrance of items into the solution. Dr. Gue's research has indicated that in general, cost savings for computer-assisted menu-planning are significantly smaller than those estimated by Balintfy's non-selective model. This is primarily due to the inherent uncertainty caused by the random nature of the consumer's choices.

At the Carnegie Institute of Technology, Miss Ellen Ekstein has developed a computerized menu-planning capability involving a non-mathematical approach to food item selection. The reasoning appears to be that this enables dieticians with limited background to understand and evaluate the model and its activites. Incorporated in an interative syetem similar to Balintfy's, it cannot and does not profess to reach an optimal solution, but rather to provide recipe information and some decision rules regarding item selection on a trial and error basis. This approach and reasoning puts this system in an entirely different category from those previously described in that its treatment is strictly logical.

As previously stated, Professor Casbergue's use of the Tulane Facility is based primarily on its use as a teaching device for student dieticians. Professor Casbergue views the concept of menu-planning as centered around the recipe as the basic building block from which all information and menu-planning procedures are based. Using individual portion menus, he points out that less waste will be generated by over-production when the expected number of portions is not an integral multiple of some standard recipe portion size. Further, data collected from the field on the amount of waste incurred (the difference between raw, edible and consumed food volumes), can be used as a measure of control over the requisitioning and preparation procedures, as well as a measure of preference.

Other universities have been investigating other areas of computer applicability to the food service functions. The Kansas State University Department of Institutional Management has started a pilot study of computer-planned menus for their residence halls. Emphasis has been placed on such elusive factors as color, shape, texture and flavor. In the future, it is expected that labor costs and equipment factors will be included. The University of Missouri Medical Center, the Pennsylvania State University Institution for Food Research and Services, and the University of Wisconsin Department of Foods and Nutrition are mainly applying computers to the inventory, production and accounting functions of food service. In addition, the University of Wisconsin is applying computers to maximize the utilization of cafeteria and personnel and to balance seating capacity and consumer waiting time. Finally, the University of Massachusetts has applied the method of computer predictions to estimating the number of students expected in the dining halls for each meal throughout the school year.

Outside of the university environment, the only work being done on the development of a computer-assisted menu-planning function has been implemented by the Veteran's Administration. Incorporating a food service function into a number of its hospitals throughout the country, the V.A. has adopted the basic idea of using a recipe and ingredient file to produce an optimal selection of recipes chosen for optimal preference for a continuous 28-day period. The model formulated incorporates many of the features used by Doctor Balintfy, such as preference, frequency of service ranges, nutritive requirements and budgetary controls, but does not attempt to produce an actual menu plan. Instead, the V.A.'s computer model generates a list of recipes to be served with the corresponding number of times within the 28-day period it is to be served, but without attempting to combine these into a sequential menu plan. This frequency of service chart is then used by trained dieticians who manually combine the selected recipes into an ordered menu plan. It was felt by Miss Brisbane that the subtle considerations required to structure an actual menu are beyond the present capability of computers. However, this recipe selection process is only part of a larger system which incorporates the selected recipe list into an inventory control and requisitioning formation. Based on the selected recipes and their ingredients together with such information as the hospital's census, requisitions of ingredients are automatically obtained.

Some novel ideas have been included in the system. Selection is made for a basic diet and several modified diets which comprise the bulk of the feeding function. Using these computer-generated lists as a starting point, manual modifications are made to suit the individual requirements of special patients. In addition, the computer model is used to generate a solution based on optimal preference or minimal cost. The latter is designed to indicate how using preference as the objective function has tempered the selection of the minimal cost solution, providing information useful for substitution selection.

It is interesting to note that the system has been installed in a number of hospitals, all with a great deal of success. Furthermore, the selection model uses a standard linear programming computer program (M-3, written by Standard Oil of California) without recourse to experimental models such as developed by Balintfy. This has the obvious advantage of not requiring the V.A. to incur the costs of developing an experimental system, while it has the disadvantages of preventing full use of the data base available as demonstrated by experiments reported at Tulane. Without the interactive nature of a system such as developed at Tulane, the dietician does not have ready access to the data needed to combine the selected recipes into a cohesive food plan. Moreover, the dieticians' individual decisions can not be quickly evaluated to aid in subsequent decisions. On the other hand, the V.A.'s effort is particularly noteworthy in that it is not a research effort, but an outstanding example of a feasible solution to an obviously complex problem.

B. Military

In contrast to the research efforts of the aforementioned universities, the U.S. Military's use of computers in the food service area has been tempered by the need to provide immediate assistance to the most difficult task of relieving some of the computational and clerical operations in the reporting phase of the menu-planning function. Thus at this point in time, the military's efforts have been limited to the accounting and reporting functions which are ancillary to experimental systems described earlier. In essence however, much of the preliminary work has been done in compiling and coding the master menu file and an ingredient file.

As outlined by Mrs. Gotschall's presentation at the Symposium, the Air Force's involvement with computers centers around its ability to retrieve data from several master files in compiling a wide variety of management documents including cost analysis, nutrient analysis and ration factor analysis for each of the 25 separate requisitioning agencies.

The U.S. Army Food Service Center Office in Chicago has a similar limited computerized food service facility. Using a Univac 1005 Card Processor, the facility's principle objective was designed to expedite the preparation of two basic documents generated from the Annual Food Plan; the Master Menu and the Recapitulation. This facility is very similar in purpose and complexity to the facility used by the U.S. Air Force. The principle purpose of this capability is to reduce the amount of manual clerical effort necessary in producing these documents by having the computer extract pertinent information from the various master files, and combining them into usable forms in a manner consistent with formerly used manual procedures.

Undoubtedly the most comprehensive food service system currently being undertaken by anyone is that proposed by Captain Jane Sager of the Walter Reed General Hospital in Washington, D.C. Although still in its infancy, the plan being pursued by the Production and Service Branch of the Hospital's Food Service Division contains the essential features of a total Food Service Information System. The approach that has been taken is to divide the project into three phases directed toward a single goal. The first phase, concerned with recipe expansion, uses a manually prepared menu and produces information necessary to provide a basis for food ordering and the development of a perpetual inventory system. The second phase is a rather ambitious effort to tie together the remainder of the total system exclusive of the actual menu-planning function. Labor costing, work scheduling, nutritional analysis and an equipment information system are included. These two phases center around the Master Recipe File and a manually prepared menu which is similar, but more expanded than the U.S. Army and Air Force's primary data base.

The third phase of the project will consist of the inclusion of a selective menu-planning function. Details of what is being planned are not available, but it appears that it will include an interactive capability similar to what has been developed at the University of Florida.

Using an overall integrated plan or goal, the Food Service Division of Walter Reed General Hospital has segmented and begun implementation of three distinct phases of the planned food service information system in a logical order based on the immediate and most pressing need. The rationale for the order of implementation is based on the immediate effectiveness of reducing the clerical task surrounding the manually prepared menu. Since the cyclic rate of these menus requires that a new one be prepared at most three times a year, the computerized menu-planning capability has been postponed pending completion of the more effective areas of computerization.

In summary, the military's use of computers in the food service function is initially geared towards reducing the clerical operations surrounding the manually prepared menu, and plans have been formulated in one instance for expanding this capability to provide an overall integrated system spanning the food service function.

III. APPLICABILITY OF ON-GOING DEVELOPMENT

A. System Model

The present system is divided into three main functions as shown in Figure 1 on the following page. These functions are: Planning which develops food plans for supply and menus which it passes on to service, Supply purchases and distributes foods in accordance with the food plan and, Service which prepares the food in line with the menus and feeds the troops. Information is also returned from supply and service to planning. This includes preference data, menu approval, prices and availability.

For purposes of this study, two basic restraints will be imposed. The first restraint is that the supply function will continue to be performed by DPSC and this subsystem will be treated as a "black box". Secondly, the overall system is and will continue to be a plan-based deterministic system as opposed to a demand-based stochastic system. The plan-based system is one in which the plan is made and supply and service follow the plan, whereas a demand-based system has no plan,- so that supply and service must anticipate and be able to respond to the random demands of consumers. Although these overall economic and organizational considerations should be an object of analysis, they are beyond the scope of the present study whose major concern is with the planning and servicing functions of the system.

Although the question of whether or not the system should be a plan-based system is not the consideration of the study, some of the consequences of its being a plan-based system are of interest. In an idealized steady-state environment, the plan system could theoretically work without any inventory at all, i.e., planning decides well in advance what food is going to be consumed. Service purchases and has delivered at the proper date the required food, and service feeds it. In a demand-based system an inventory is required because of the randomness of the demand. On the other hand, the weakness of the plan-based system is that it does not have an inherent mechanism for responding to changes as does the demand-based system which is predicated on randomness or change. Flexibility

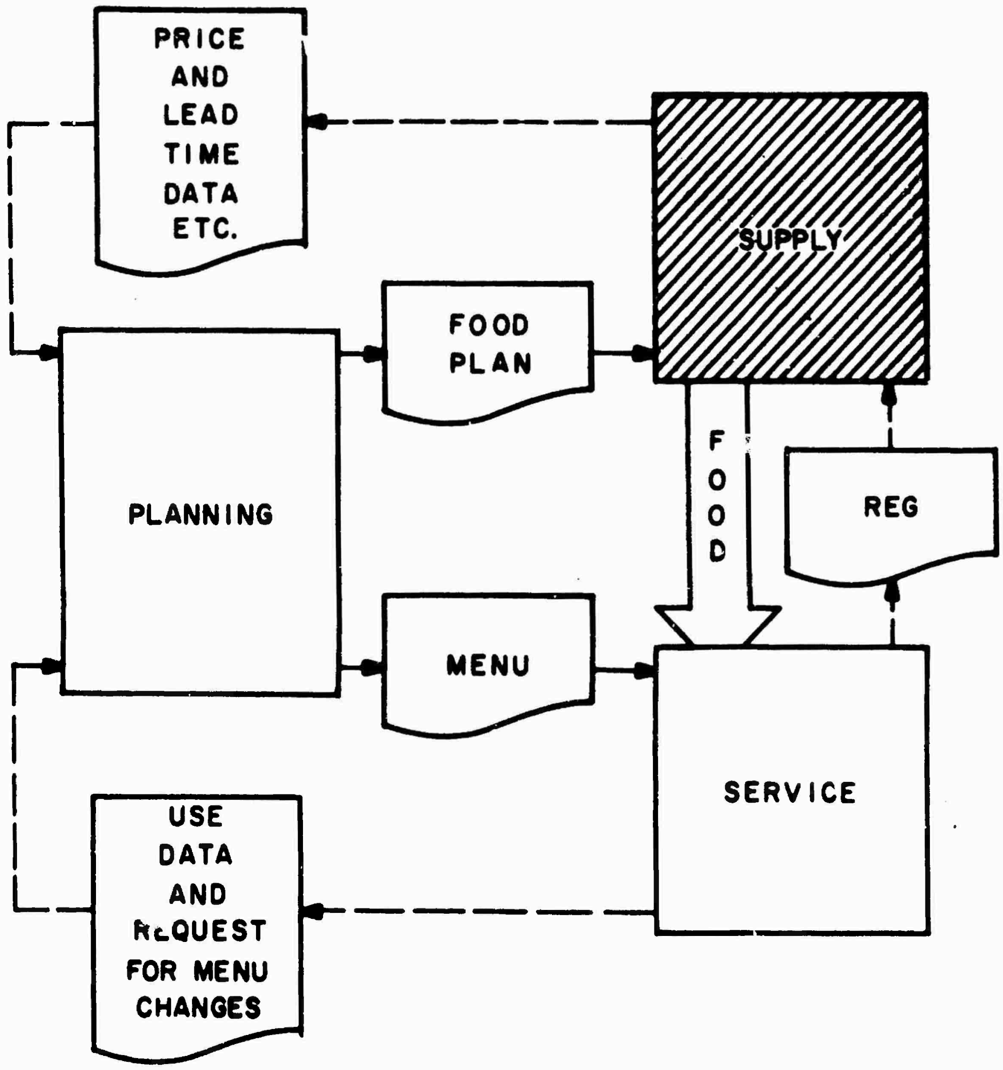

Figure 1

FOOD SERVICE SYSTEM MODEL

and speed in responding to changes or variations is therefore an important requirement of a plan-based system, and is an area in which computer applications are most promising. Another consequence of using a plan-based system is that the supply function is not as interconnected with the other subsystems as would be the case in a demand-based system. Consequently, treating the supply function as a "black box" does not necessarily introduce the inefficiences sometimes associated with optimizing subsystems independently of one another. Planning also enables DPSC to purchase seasonally or on a long term basis. This is a unique feature of the DoD system as opposed to other menu-planning systems, e.g., hospitals and the like.

In the following sections, a logical model of the food service system is developed. This is not a proposed system nor is it considered a definitive system. Its purpose is to form a framework for discussing the applicability of ongoing research to the needs of DoD. Capabilities to be expected of a modern food service system are also outlined so that the relevance of current research can be addressed to these considerations. Again, the considerations enumerated are not to be thought of as an exhaustive list or as specifications for a proposed model.

Planning Subsystem - Capabilities

Because of the environment in which the planning subsystem operates, it is required to respond to most of the randomness and diversity to which the overall system is subjected. Therefore, the salient features of a planning system must be speed and flexibility. Outlined below are some of the capabilities which could be incorporated into a system. These capabilities are all by-products of the primary requirement that the system have speed and flexibility.

1. It would be desirable to tailor food and menu plans to particular needs or circumstances, thus servicing needs more efficiently. In order to do this, plans could be prepared for various classifications. Among those classifications considered, might be "theater of operation," as is done now by the Air Force; facility size; refrigeration capacity per unit,

and physical activity levels of base personnel. Since troops in boot camp require meals considerably different from those served to a regular guard company, the last case would provide for meeting those special requirements. Ships could also be considered, and the various classes of vessels could be typed to reflect differing storage capacities, cooking facilities, etc. The foregoing are only some of the considerations which could be used to classify facilities. It should be noted that the classes mentioned are not mutually exclusive and therefore the number of possible combinations may be quite large.

2. The flexibility required to optimally determine at the last minute how much of a commodity should be purchased would be highly desirable. This capability would allow the food service to perform their function in a more efficient manner than the current system where the entire food plan lead time is based upon the maximum commodity lead time and the lead time for the most distant theater of operation. In a flexible system, simultaneous decisions could perhaps be made for beef to be delivered to NATO in twelve months, beef to be delivered in the continental United States within six months, apples for NATO in eight months, and apples for the continental United States in three months. Decisions that are made, such as beef for NATO twelve months hence, would be recorded by the system. Subsequent decisions would take into account the fact that beef had already been ordered for that time period. In this way, a more or less continuous re-evaluation of a food plan would take place with purchases being made only when required and with full knowledge of what had already been purchased. Continuing this process until the last item is decided upon would produce a food plan for a short period of time, e.g., a month. The monthly food plan may then be developed into a menu plan. Note that such a food plan would be developed for NATO perhaps six months before serving because the last item must be purchased with a long lead time for shipping. It should also be noted that such an operation involves developing many tentative food plans before the final one is decided upon, and this must be done for the various theaters of operation and other classifications.

3. A system should be capable of responding quickly and easily to changes required due to local or unusual circumstances. For as mentioned previously, one of the fundamental characteristics of a planned system is that it does not have the inherent capability of responding to changes; it therefore requires speed and flexibility in planning.

4. Among the less tangible but nevertheless important capabilities required of a system is the ability to point out which restrictions are constraining solutions, and the ability to retrieve data from the field. Formal and automatic methods of data retrieval from the field will aid in the performance of medical experiments and experiments conducted to test the acceptability of new products. Such data from the field will also aid in establishing preferences for use in developing non-wasteful, selective menu plans.

<u>Planning Subsystem - Model</u>

The planning subsystem and its relationship to its environment are shown on Figure 2 on the next page. Central to this subsystem is its data base, which includes the following information:

1. Recipe File

   Title
   Weight
   Color
   Texture
   Identification-Menu Course/Course Type/Basic
     Ingredient/Ingredient Sub-class
   Portion Size
   Minimum Batch Size
   Ingredient Names
   Ingredient Amounts (Raw)
   Ingredient Amounts (Edible)
   Preparation Procedures
   Preparation Time
   Equipment Needs
   Frequency Rating Limits
   Preference

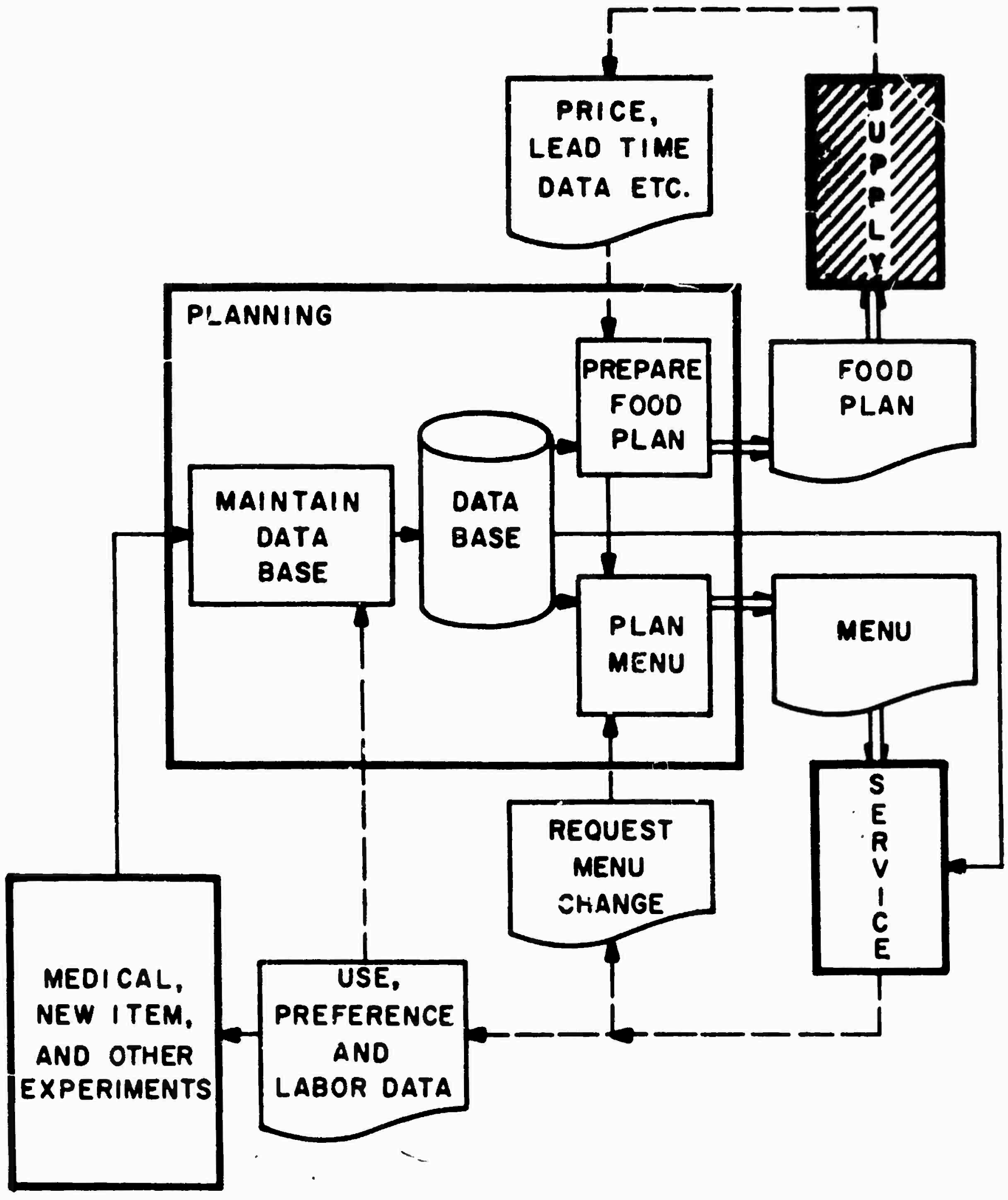

Figure 2

PLANNING SUBSYSTEM MODEL

Labor Cost for Preparation (this will become a factor because of Project PRIME).

Factor Relating Preference of Menus and Combinations for Selective Menus.

Prepared Factor*

2. Ingredient File

Name
Price Per Unit
Weight Per Unit
Unit of Issue
Shelf Life
Storage Requirements
Nutrients After Preparation
Percentage Lost in Preparation
Refuse Forecast
Availability
Source
Storage Volume

The data base must be maintained so that it will contain the latest information. This maintenance function will require feedback from service which will include data as to preparation time in the kitchen and preference data. Preference data may partially be arrived at by garbage measurements, but in the case of selective menus other measurements may be required, e.g., when two items are served in competition and one item completely runs out, then probably the other item will be served to the remaining people. Measurements of waste will not show the preference, therefore data regarding the runout point may have to be recorded and returned. This and related data will be reduced and used to update the data base. New medical data and new recipes should also be put into the data base when required.

*This factor is used to determine whether or not an item is prepared during serving or before serving, e.g., eggs are prepared during serving, and if not selected, the unused eggs would be returned to storage. However, an item which had to be prepared in advance of serving would be wasted if unused.

Using the data base, food plans may be prepared. In order to perform this function, the food plan subsystem requires feedback from the supply system of actual prices, predicted prices and availability of commodities. For overseas operations, factors or constraints may be supplied which can be combined with the volume of menus so that considerations of transportation and/or storage may be entered. Supply will also determine groupings which are meaningful from a supply point of view, e.g., which areas are to be included in a theater of operation.

With this information, food plans may be generated; however, if it is desirable to have a continuous food planning system (such as described previously), then supply must also feed-back information regarding "lead time." The lead time may be a function of commodity, theater of operation and time of year. Continuous food plans may then be generated to the supply subsystem that contain information as to what is to be purchased consistent with the required lead times. Also, when all the items have been ordered for a particular class of bases, then the monthly food plan is submitted to the menu-planning function. It could be submitted earlier in order to give the field time to respond with comments.

The menu-planning function uses the monthly food plan and information on the data base to prepare the menu for the particular class, and distributes this to the pertinent service bases. It may also get feedback from the field as to the changes requested in the menu.

Menu-planning could serve in a slightly different manner, i.e., it could be used as the last stage of food planning. In such a mode of operation the food plan would be developed for all long lead-time items, but the final food plan would be developed on a menu basis. This would insure that the recipe selected could always be put into a set of menus for the month. This mode of operation would also enhance the ease with which menu plans could be sent to the field and returned with comments before the final menu plan is developed

Service Subsystem-Capabilities

The service function (or base kitchen) contains within itself most of the functions of a complete business system. It has inventory control, consumer demand forecasting, cost reporting and production scheduling and control subsystems. Although these systems are very complex, they are in some cases so small that rule of thumb performance may be sufficient. It is also to be noted that the requirements of subsystems can vary greatly between bases. As an example, the inventory considerations on a vessel are considerable, whereas for a land base near a DPSC warehouse the inventory problem may be trivial. On the other hand, a ship at sea does not have a great problem in predicting census, whereas this may not be true for a land base. For these reasons, it is desireable that a base level system have a degree of modularity which could be implemented at various levels of sophistication depending upon the individual subsystem requirements within a particular base, e.g., a subsystem for menu modification could vary from a system which would have the capability of calculating the cost and nutrient values of a proposed menu, to a more complex system which could aid in the optimization of menu selections.

Service Subsystem-Model

Figure 3 on the following page shows a Model of the Service Subsystem. Information from the planning subsystem in the form of a menu plan is input to the service subsystem. Within this subsystem, the menu is first operated on by the menu modification function. The menu is modified to take advantage of local conditions and prices. Menu modification is performed using the recipe data base in order to insure that cost and nutrient requirements are met. Finalized menus are passed on to the operations function.

The operations function controls most of the other functions within the service subsystem. In order to perform this control, it requires predictions as to attendance and preferences. The operation function also requires data from the data base, particularly with respect to preparation time, cooling instructions, resource requirements and resource availability. With this data, operations develops performance and scheduling requirements for the subfunctions of inventory control, cooking and feeding as follows:

1. Inventory control receives from operations information regarding the amount of food required during a specified period of time, and a schedule as to when these foods are to be delivered to the pre-preparation room.

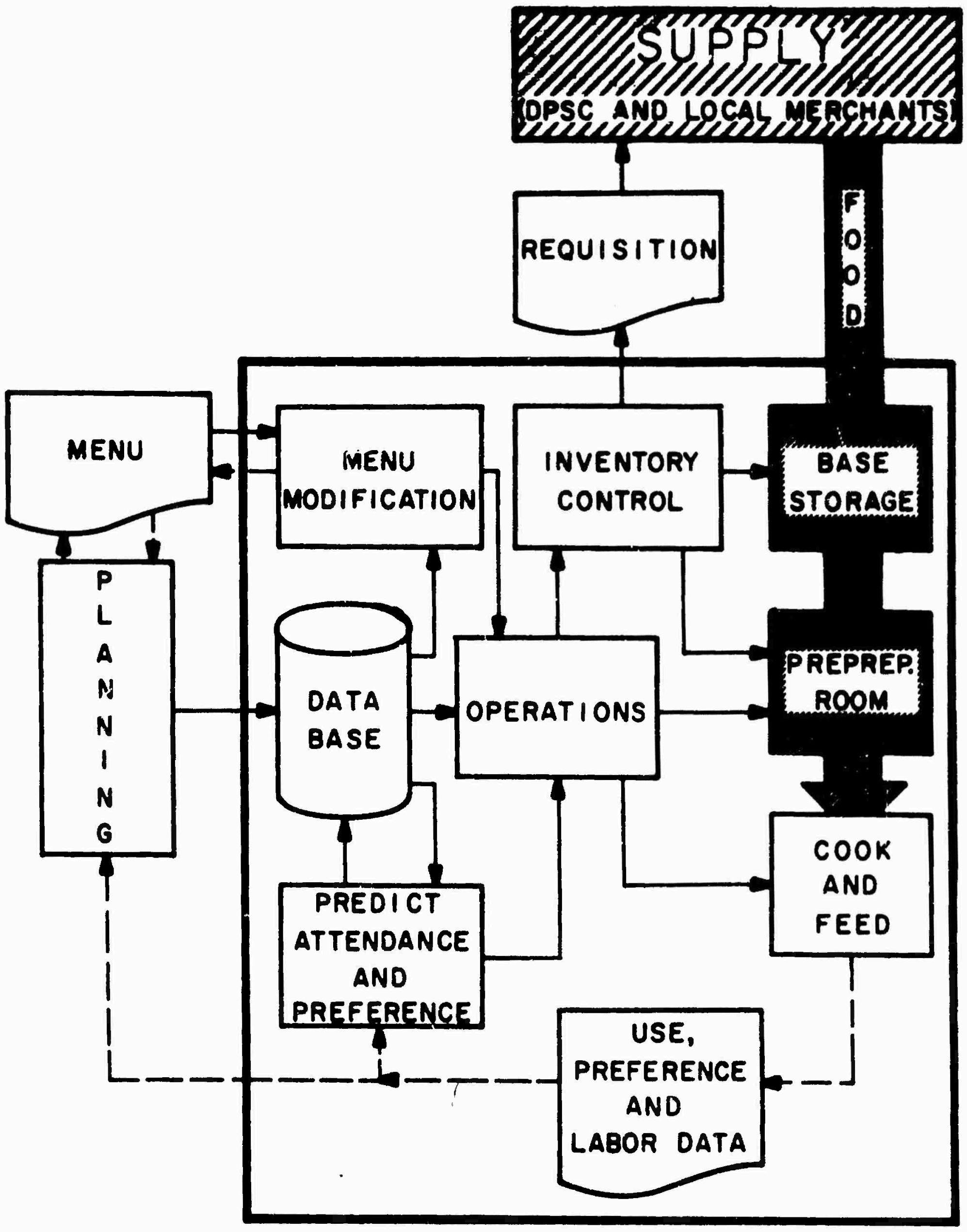

Figure 3

SERVICE SUBSYSTEM MODEL

Given these requirements, inventory control must consult the base warehouse inventory and requisition from DPSC or local merchants the foods required. Inventory control keeps the appropriate accounting records and if the food is stored for a long duration (as is the case with a ship), shelf life and other warehousing problems must be considered. In accordance with the schedule developed by operations, inventory control delivers to the pre-preparation room the foods required.

2. The operations function produces a schedule for use within the pre-preparation room which will insure that the proper ingredients are ready for cooking when the kitchen requires them. In order to do this, the operations function takes into consideration the resources of labor and material which are available in the pre-preparation room.

3. The "cook-and-feed-function" receives from the operations function schedules and resources to be used for the preparation and serving of each recipe. These instructions could be no more than a list of ingredients and the time required, or they could include batch sizes, pots and other utensils, labor skills and the time required for the various phases of recipe preparation.

The base level services system is required to gather data for feedback to the planning subsystem and to the predictive functions on the base itself. Information is gathered on the actual use and preferences displayed at each feeding. Actual use data can be attained from waste measurements. However, this will not necessarily pinpoint preferences in selective menus. To ascertain preferences in selective menus, factors such as run-cut time of competing items on the menu may have to be retained. Data regarding the actual time required to cook and serve items, and the labor invol ed in this process, must be measured in order to develop more accurate data for the recipe data base. The data gathered by this function can also be used as labor cost data for input to the base management information system.

Attendance and preference predictions must be made for input to operations. The attendance prediction is entirely a localized function, an the preference prediction made on a national level may need to take local tastes into account.

B. Comparative Evaluation

Comparative evaluation of on-going developments as to their applicability to the system model divides itself into two major areas--planning and service. Most of these developments at universities and in hospitals are applicable to one phase or another of the system model, and indeed, most of the functions within the system model have been the object of development in one or another of the on-going systems.

Planning Subsystem

Most of the on-going developments pertinent to the planning functions have taken place at The Veterans Administration and at the Universities of Tulane, Florida and Ohio State, and the Carnegie Institute of Technology. All of these systems have data bases similiar to the recipe data base enumerated in the model. Using these data bases, they try by one means or another to arrive at a near-optimal selection of foods which meet dietary and other restraints. The work of the universities is directed primarily at computer-assisted menu-planning, whereas the Veterans Administration's computer usage is directed at developing a food plan which is then put into menus by dieticians without computer assistance. The work of the V.A. is quite pertinent to the food planning function in the system model, whereas the work at the universities is applicable to the menu-planning function in the system model.

With minor modification, the linear programming system used by the V.A. would be directly applicable to the food planning function in the system model. The primary purpose of the V.A. system, as would be the purpose of the food planning function, is to decide on what food needs to be purchased and to give this information to the supply function in sufficient time. In order to do this, the V.A. uses a data base similar to the recipe data base in the model. It also receives feedback from the supply function as to current or predicted prices and availability. With this information, and using a large linear programming system, the V.A. is able to develop a food plan with a duration of approximately 28 days which will commence approximately 4 months after calculation. This type of system could be used with very little modification to give food plans for various theatres of operation and other classifications of bases.

One of the major differences between the V.A. system and the continuous food plan which DoD may wish to use is that the V.A. lead time is a constant for all commodities, whereas the continuous food plan allows for varying lead times.

The generalized nature of the linear programming system which the V.A. uses lends itself quite easily to the process envisioned in the continuous food plan. After a group of commodities has been selected for a particular food plan, this information can be fed back for use in later calculations. The information could be returned in the form of constraints which would require that the commodities be used in subsequent food plans. Alternately, the commodities previously selected could be assigned a price of zero which would probably ensure their selection in subsequent food plans. (The 0 price is only for optimizing purposes. The true price must also be kept so that the maximum dollar value of the meal is not exceeded). Thus, although some additional information handling will have to be developed if DoD uses continuous food planning, the basic V.A. system is nevertheless applicable.

The work of the universities has involved making menu plans from which food plans are subsequently developed. This process is the opposite of that envisioned in the model. Nevertheless, there is a need in the model for computer-assisted menu-planning which would aid the dieticians in selecting menus which do not violate restraints; e.g., nutritional, cost, frequency, and preparation time. The programs developed by the universities could be used to do this. However, the facilities for selecting optimal menus would not be used, since the selection will have already been made by the food planning function.

In an alternate method of using the model, the menu-planning function can be the last stage of food planning. Here, the food planning function decides on all of the long lead-time items and this information is inputted to the menu-planning function which would select the short lead-time items and make menus for the month. The menus thus selected comprise a final food plan. This latter method of operation would allow for the menu functions to develop a menu plan which could be checked and commented on by the field.

If the menu function in the system model is used to develop the final food plan, then all of the capabilities which have been built into the universities' menu-planning systems would be of use since final optimization would take place in the menu-planning function. Because most of the selections would be performed in the food planning function, the precision with which optimization takes place in the menu-planning section would not be critical and therefore good approximation such as the modified integer solutions developed at Tulane would be most useful. The work at the University of Florida on selective menus is most pertinent because selective menus promise to meet preference requirements to a much higher degree than standard menus would. However, the development of non-wasteful, selective menus requires considerable time from dieticians. Presently, the dietician's time is not a critical factor, but with the envisioned use of the model, there would be hundreds of menus to be planned.

Service Subsystem

The process of menu modification on the base level makes use of the same computer techniques as does the process of menu preparation in the planning system. Therefore, the computer applications in menu-planning developed at the universities will be applicable. Much of the optimization capability in these programs will be unused.

Within the service subsystem there is a requirement for predicting attendance and preferences. At the University of Massachusetts, mathematical models have been developed to perform these predictions.

In the service subsystem, the function of operations and all of the functions controlled by operations, e.g., inventory control, pre-preparation, cooking and feeding, comprise a production operation which has been extensively studied by Captain Sager of the Army Hospital Food Service. The first two phases of Captain Sager's developments, the recipe expansion function and the scheduling and resource allocation within the kitchen, are most applicable to these subsystems. Captain Sager has left menu planning to a third and last phase of development. The total system proposed by Captain Sager, when implemented, would be a completely integrated and comprehensive service system.

Thus, all of the functions outlined in the model are being implemented by one or another of the researchers mentioned.

IV. AREAS REQUIRING FURTHER TECHNOLOGICAL DEVELOPMENT

In reviewing the areas of applicability of on-going research coupled with other well-defined computer techniques, the conclusion can be drawn that there are no important technological problems impeding the development of a fully integrated food service information system. There is no question that a system such as has been described here and in the literature can be implemented leading to drastic improvements in lead time, cost, overall performance and flexibility without further technological developments.

However, when such a system is to be used in the context of the needs of the armed forces, technological problems develop which are distinct from the application, but common to every large-scale system. All of the research and development activities which have been undertaken in the area of food service information systems have limited their area of influence to relatively small consumer populations such as found in hospitals or schools. No one research activity has implemented a single system containing all or even most aspects of a comprehensive food service information system. To expand the area of influence to the proportions of the armed forces, and to envision a comprehensive system in this environment, introduces a change of scale of many orders of magnitude and complexity which alters the emphasis of the problem to one of sheer size.

Dr. Buck, in one of the working sessions, described a large-scale computerized information system which would be tailored to the needs of a food service application and stated that it was already feasible! Although conceptually the system is feasible, no such system has ever been implemented. With the present state of computer technology, the cost of the memory and communicating equipment that would be required is prohibitive. Furthermore, the reliability and responsiveness that can be expected from such a system would be well below those required of the application. Recent efforts by IBM and other major manufacturers in developing large-scale interactive systems indicate that progress in these areas will continue to be slow and costly without major breakthroughs in system performance. It remains to be seen, based on the scope and depth of the DoD's intentions in this area, whether a computerized food service information system is feasible.

In implementing a workable computerized menu-planning function, the mathematical techniques employed in on-going developments require supplementary man-machine interactive adjustments in order to achieve a truly palatable menu. Miss Brisbane defended her manual menu-planning procedure with the argument that the state-of-the-art had not advanced to the point where the subtleties of taste and overall preference could be included in any mathematical model. Further, Dr. Balintfy has stated that "it is not necessarily true that the preferences for individual menu items are additive." These opinions imply that the underlying judgement of the relative preference of an entire menu plan is considerably more subjective than the use of individual preferences makes possible. Before substantial improvements can be made in the generation of computerized menu plans without substantial assistance from a dietician, the codification and evaluation of factors such as color, texture and prefer nce will have to be developed and incorporated into a mathematical algorithm. Moreover, the combinatorial effects of these and other factors, and procedures to handle them must be developed in order to provide a generally acceptable menu planning capability requiring minimum intervention. Finally, in adapting current planning research efforts to the use of the armed forces, modifications will have to be made to provide for logistic considerations such as the factors influencing the use of carcass meats cited by Miss Bollman.

The on-going research efforts have centered their attention around the use of linear programming as the mathematical model of the menu-planning function. Because of its well-defined nature and the availability of existing computer programs, many assumptions and approximations have been made in formulating the model to fit the technique. Aside from the aforementioned considerations of combinatorial preference considerations and logistics factors, several other factors can be cited as contributing to sub-optimal rather than truly optimal solutions. One of these involves the implementation of the frequency limit constraints, Balintfy's model prohibits the use of a menu item if its use would violate the minimum interval restriction. It appears that a more efficient and optimal method of handling this constraint could and should be found without regard for the constraints imposed on the model by the linear programming technique. In addition, current research efforts optimize on an individual or daily basis. This again is a restriction that is imposed by the linear programming technique. Only through further investigation can it be determined whether improving this form of sub-optimization is worth the price of increased model complexity.

With these considerations in mind, it appears that the mathematical linear programming model used in current research may not be adequate in providing a competent menu-planning capability without substantial human adjustments. Research is needed in this area to develop a more sophisticated mathematical model capable of handling the considerations deemed necessary for palatable menu-plan formulation. This may result in a model for which there is no known solution, requiring further efforts in either formulating its solution or evaluating various methods of simplification. Even if a method of solution is known or can be developed, it remains to be seen whether its computer solution is feasible since it may require excessive amounts of computer time or computer memory, making it either totally unusable or prohibitively expensive.

The expansion of existing mathematical techniques is intended to increase effective optimization and reduce the number of manual interactive adjustments required. As stated earlier, most of the complex factors can be handled without incorporating them directly into the mathematical model by the use of an interactive adjustment procedure such as Balintfy's, which supplements the computer's solution with a dietician's judgement. However, as research at Tulane has indicated, increased human intervention decreases optimization so that, in general, the simplifications embodied in current mathematical models result in a twofold reduction in optimization. It seems, therefore, that a totally different approach from the one requiring extensive revision to present models could be developed, taking advantage of the very interactions that the revisions are attempting to reduce. It seems desirable, therefore, to allow these interactive modifications between dietitian and computer to influence future computer-developed menus by the dynamic formulation of generalizations and selection criteria within the computer, as displayed by the pattern of these interactions. Although "learning models" such as this are well beyond the current state-of-the-art, there is no doubt that they offer a most promising future in computer applications requiring logical influences based on experience in the exercise of human judgement.

Appendix A

PROCEEDINGS

OF THE

CONFERENCE ON

COMPUTER PROCEDURES FOR MENU PLANNING

HELD AT

U.S. ARMY NATICK LABORATORIES
NATICK, MASSACHUSETTS

April 4-5, 1966

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SECTION I

TRANSCRIPTS OF PREPARED PAPERS

INTRODUCTION

Lt. Col. Jesse W. Webb
Directorate of Food Services
Office of the Secretary of Defense
Arlington, Virginia

Ladies and Gentlemen, Good Morning ---

By taking your time to come to this conference to explore Computer Procedures for Menu Planning and Recipe Service, you demonstrate your interest in this new approach to planning for group feeding for all the Armed Forces. I especially want to thank those who have come from universities and non-military government agencies for so generously giving of their time and knowledge to assist our study.

The potential applications of menu planning by computer are sufficiently well known to require only emphasis. These applications include not only long-term planning of master menus, but also rapid responses to changes in availability, costs or requirements. Comparative evaluations of different menu plans based upon user-specified requirements, and tests of the effects of the introduction of new, experimental ration items into the feeding system will also become possible. Machine planned menus can be designed to interface directly into EDP systems for scheduling procurement and issue and for inventory control. Undoubtedly, other applications will be suggested by your comments during the course of this conference.

At least five benefits are expected to result from these applications. These include:

1) More rapid accomplishment of the planning cycle with consequent reduction in lead time.

2) Increased flexibility in planning.

3) Increased ability to vary requirements or to alter plans to meet new requirements.

4) Expansion of planning criteria to include factors now too difficult to use in manual planning. And

5) Especially, the elimination of routine manual effort in all phases of menu planning and recipe service. This will free our professional dietitians so that they may perform other important professional tasks.

Certain assumptions, although not essential to the development of a complete system for military use, should underlie our discussions. Our primary concern is large-group feeding with standard menus. The significant problems associated with feeding in aircraft, smaller ships, or mobile units in land combat will not be ignored, but rather deferred to a second-generation development. Second, the over-all requirements, procurement, recipes, and monetary allowances will be the same for all services. Working groups reporting to my office are now studying this area, and realization of the goal is expected soon. Third, existing EDP procedures within military food service organizations will be integrated into any new system to the maximum possible extent. Finally, current regulations will have to be considered applicable until they are changed.

The purposes of our discussions are five:

1) To determine what the users expect of a system.

2) To determine the requirements of the menus to be planned.

3) To discover what input information is needed, what is presently available, and what reliability will be necessary.

4) To establish the status of existing EDP procedures and the extent to which compatibility between them and a planning system can be maintained.

5) To begin, if possible, the modeling of a system to fulfill these needs.

To accomplish these purposes we shall have formal presentations, followed by informal discussions. The presentations are intended to set the stage by depicting the rules under which we must operate, some of our accomplishments, and some of our expectations. In your discussion, you will explore these areas in greater depth to insure that all pertinent points of view are noted.

To assist in these explorations, we have with us Mr. Roger Baust and Mr. Michael Hopper of Adams Associates Inc., who have been engaged to participate in the discussions, to direct questions to insure that all needed information is brought to light, and, more importantly, to discover the gaps, if any, in our present knowledge. They will complete the study initiated here through a review and evaluation of the proceedings and by making recommendations for our next actions. These gentlemen are skilled systems analysts and bring with them considerable experience in similar studies. They are not, however, necessarily experienced in food service problems. For this reason, you, who are the potential users of a computer system for menu planning, must tell them what you expect of the system and what you have available to make it work. We expect some sparks to ignite new ideas, and we also expect to light a sufficient fire to illumine the broad problem.

Unfortunately, I will not be able to stay to participate in your working sessions. I have with me, however, Mr. Herbert McCarthy of our office who will participate. Mr. McCarthy will be the point of contact in our office on this project. He has a good background in the EDP Systems area.

I am glad to see all of you here this morning, and, again, I thank you for coming.

MENU PLANNING, AN OVERVIEW

(Outline)

by

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Assistant Professor

Division of Medical Dietetics
School of Allied Medical Services
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INTRODUCTION

The application of EDP to dietetics and food service management is in its infancy. Achievements to date are chiefly those of a very few research-oriented persons, institutions or organizations.

Efforts have been limited to a large degree by a lack of knowledge and understanding of EDP among those who have considerable knowledge of food service management. It is hoped that the Armed Forces' investigation into this subject may provide some of the sorely needed motivation, understanding and interest among other members of the food service industry.

Assumption: A food service information system that provides information for management decision-making is more worthwhile than one that only meets the need of management to control activities at lower levels within an organization.

DATA REQUIREMENTS OF A FOOD SERVICE INFORMATION SYSTEM

The basis, after profit or other goals are defined, for most decisions in a food service system should be the recipe. Whether it is or is not has been argued for years among those who view food preparation as an art rather than a science and those who feel that food preparation can, frankly speaking, be almost as exact as building an airplane. The reason for a qualification is, of course, due to the fact that food is a product of Nature and that there is variation in nutrients, moisture, flavor and other factors. The argument becomes less academic when consideration is given to application of EDP to food service management. A computer works on data. It can not perform computations on data that exist only in a manager's or cook's head, no matter how knowledgeable the latter may be. Therefore, the basis for a food service information system must be on quantitative and accurate data. The relevance of the recipe becomes apparent in the following illustration of the CONTROL relationships of the menu and recipe in a food service system, see Figure 1.

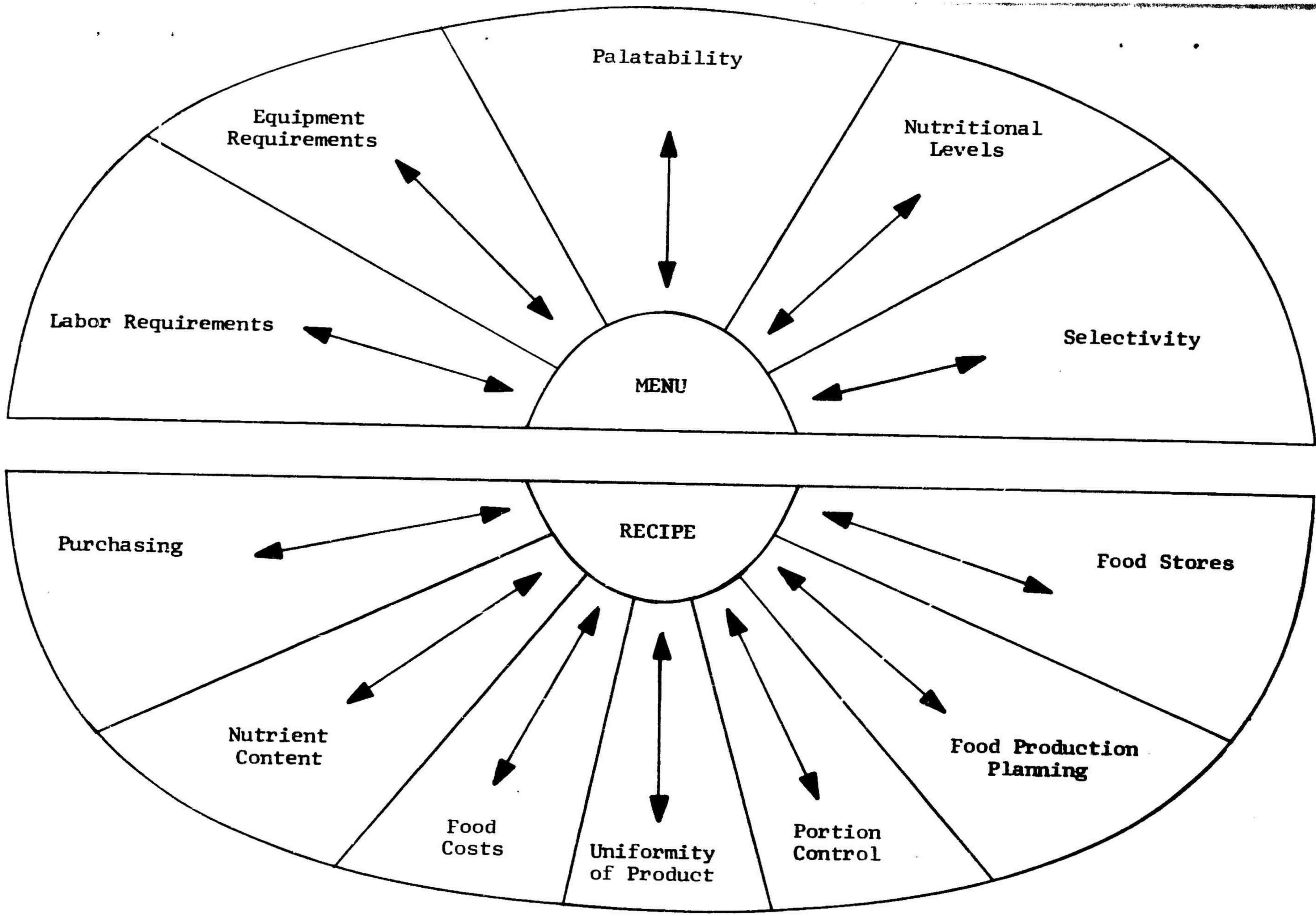

Figure 1

CONTROL RELATIONSHIPS OF THE MENU AND RECIPE
IN A FOOD SERVICE SYSTEM

The recipe file is the source of menu items, while the menu (and pattern) controls those items as shown. After the menu selection is complete, the recipe again becomes the source of data for decision-making.

The basic requirements for recipe data in a food service are shown in Appendix A to this paper.

The requirements and implications of data and data collection are discussed further in the Proceedings of the First Conference on Computer Applications in Nutrition and Food Service Management[1].

I. DESCRIPTION OF PRESENT STATE OF THE ART IN APPLYING EDP IN A FOOD SYSTEM

A. Computer-Assisted Menu Planning (CAMP)

1. Work on the mathematical models of CAMP was initiated by Brisbane[2], Balintfy[3] and Liggett and Gue[4,5]. The feasibility of CAMP is being demonstrated, at present, in two hospitals in New Orleans, Louisiana under the direction of Dr. J.L. Balintfy[6]. Capability has been developed for planning selective[7] and non-selective menu planning with nutrient levels and food costs optimized. Necessary adjustments for palatability factors are made by on-line alteration of each day's menu by a dietitian via a remote terminal located in each hospital. The recipe file of each hospital is used to select menu items to fit the respective menu patterns. The use of cyclic vs. dynamic menus (changing as the market fluctuates) is a point for major consideration at this Conference.

2. Brown[8] and others have studied palatability factors and costs as restraints using a random selection process.

II. FOOD SERVICE PLANNING*

A. Forecasting

When census and selection or popularity data are provided, the following information can be provided on manually or computer planned menus:

1. Food costs per person and total for any meal, day, interval or average for period based on current or projected (if available) prices.

2. Nutrient levels (presently including 17 nutrients) of each meal, day, interval or average for period of a non-selective menu.

3. Food requirements of individual unit or multiple of units for any selected menu period.

   a. Total requirements for bid or contract purchases.

   b. Daily or other period for schedule of delivery for production requirements. (Processing of receiving storage and inventory control data is not included at present.

4. Updating census and selection information.

5. Calculation of storeroom food issue authorization based on precise amounts necessary for current day(s) or period production requirements. Loss in peeling, draining etc., is calculated in determining issue amounts.

6. Calculation of cook's recipes for precise production requirements (directly related to amounts of food authorized for issue from storeroom).

7. Total costs of food issues are calculated.

*Based on those factors presently included in the Ohio State University medical dietetics dietary information system.

8. Nutrient and/or food intake computation for any meal, day or period if plate waste data is provided. Present uses:

   a. Individual nutrient intake for patient dietary study.

   b. Evaluation of popularity and portion size.

9. Option of updating cost or nutrient levels of any or all recipes as cost or nutrient information changes.

III. BASIC DATA REQUIREMENTS

A detailed listing of known requirements for Computer Assisted Menu Planning and Food Service Planning is shown in Appendix A.

The requirements are based on the research efforts of Dr. J.L. Balintfy, Tulane University; Helen Brisbane, Veteran's Administration; and John Casbergue, Ohio State University.

IV. EDUCATION AND TRAINING REQUIREMENTS OF TOP AND MIDDLE MANAGEMENT, (COMMISSIONED AND CIVILIAN) AND ENLISTED PERSONNEL AT SUPERVISORY OR EMPLOYEE LEVELS

The requirements for precise data and accurate performance are well established in any EDP system regardless of the type of application. Such requirements are a major consideration in a food service system. An important requirement exists for a well-considered orientation and education plan that will motivate and prepare food service personnel for such a system. There is a real question of an organization even being able to succeed, no matter how sophisticated the system is, unless all personnel are trained, willing, and importantly, motivated. These aspects must be given, in this person's opinion, due consideration before planning has proceeded very far. Selection of future food service personnel may be based on different criteria if such a system is adopted.

V. CONSIDERATION REGARDING PROCEDURES AND BASIC DATA REQUIREMENTS

1. Recipe data are not consistently used as controls for decision-making in purchasing, issue, production, timing, costing and portioning.

2. Recipes may not be a reflection of actual ratio of ingredients or procedure as menu items are prepared by cooks.

3. Limited quantitative information of food yields at various stages of production. USDA Handbook #102 provides a limited amount of information but in arriving at averages, there is considerable difference in lowest and highest yields observed. Yields used in recipes must be realistic in terms of variance in methods used. This is an important consideration in evaluating the use of prepared (dehydrated, freeze-dry, frozen or other) ingredients. Consideration should be given to purchase of prepared ingredients (prepared meats, potatoes, celery, peppers, carrots, fruits, etc.) whenever feasible in recipes and still maintain quality standards.

4. Lack of standardized techniques in food handling and preparation.

5. The availability and use of proper weighing and measuring equipment in each food operation is essential.

VI. OUTCOMES AND OBJECTIVES OF A FOOD SERVICE INFORMATION SYSTEM

1. Provide information for management decision-making.

2. Gain greater utilization of "mindpower" as well as manpower of Armed Forces' food service personnel.

3. Gain acceptance and effective use of information system by food service personnel.

4. Provide an additional means of communication among Armed Forces' personnel to gain broader benefits of expertise.

5. Increase productivity of personnel by more effective use of human and material resources.

6. An increase in capability to meet nutritional goals.

   a. Less over- or under-satisfaction of nutrient levels and food supplies through computer-assisted menu planning and more adequate forecasting.

   b. The value of maintaining food consumption patterns of large populations is considerably enhanced by capability to conduct nutritional research or survey activities as a byproduct of a management information system.

7. Capability for gaining more quantitative information regarding effectiveness of management at various levels in meeting pre-determined goals of manpower utilization, financial management, food utilization and related factors.

8. Capability for establishing and utilizing indices for evaluating factors mentioned in 7 (above), and provision of periodic reports of management's effectiveness in reaching established goals.

VII. LESS DEVELOPED ASPECTS OF A FOOD SERVICE INFORMATION SYSTEM

1. Projection and/or simulation of manpower and equipment requirements for future food service units considering presently known concepts of design simulation[9,10] and work performance[11].

2. Simulation of food service systems with maximized use of efficiency of pre-prepared or processed foods to evaluate effects on manpower and equipment requirements.

3. Simulation of food planning, distribution, utilization and control in various situations (conflicts, emergencies or disasters).

4. More quantitative evaluation of civilian contractor bids (or performance review) for operation of military food service systems when applicable.

Appendix

BASIC DATA REQUIREMENTS FOR A FOOD SERVICE DATA INFORMATION SYSTEM

I. STANDARDIZED RECIPE

A. Numbering Systems or Codes

1. Recipe code number - a unique number for each menu item in entire recipe file (open-ended for additions).

2. Food code number - a unique number for each food item that appears in any recipe. (Each variation of any food item is treated as a separate food item. Example: sliced peaches may be different in grade, packing medium, variety, unit of purchase, etc.)

3. Nutrient code number referencing nutrient tables in use. (USDA Handbook #8, Composition of Foods, Raw, Processed and Prepared; revised December 1963, was used in medical dietetics model.) Nutrient table data were available in card and magnetic tape form. (The format was found to be useable, but it was somewhat difficult and had several limitations.) Code numbers should be open-ended to allow expansion.

B. Ingredient Information

1. Standard name, form or condition used in recipe e.g., onions, yellow, thin-sliced.

2. Amount and unit of use, e.g., 1.5 lb., 8 oz., 1 gal., etc.

3. Information for conversion from recipe ingredient form to "As Purchased" (A.P.) form. (Example: sliced yellow onions may be purchased in 50 lb. bag.) Note: Code numbers can be devised for conversion factors).

4. Ingredient yield information* - Information on any change in ingredient from unit of purchase through various stages of preparation. (Example: Pre-preparation, preparation, cooking, edible portions). These factors are considered in determining As Purchased amount of each ingredient and also for nutrient computation.

   Notes: A. If product is cooked, effect on nutrients must be considered if nutrient table only provides information on raw form of ingredient.

   B. Yields are expressed in terms of percentage; if stated over 100%, (some foods absorb water on cooking), nutrients may be inflated.

5. Number of servings.

6. Minimum number of servings that could feasibly be prepared.

7. Estimated total weight of recipe after cooking.

8. Estimated weight and/or volume per serving.

9. Number of ingredients in each recipe.

C. Purchasing Information

1. Unit of purchase.

2. Unit of issue (if different than unit of purchase).

3. Weight of unit of purchase.

4. Unit of purchase cost.

*Average yield information can be found in USDA Handbook #102, Food Yields - Summarized by Different Stages of Preparation (out of print); June 1956.

5. Minimum lead time for purchase.

6. Maximum desired storage period.

7. Condition of storage,e.g., dry, refrigerated, frozen.

8. Amount to purchase when needed.

9. Stock level desired.

10. Method of purchase, e.g., bid, local purchase, etc.

11. Volume of unit of purchase (for estimating storage requirements).

D. <u>Recipe Information Calculated by EDP from Above-Listed Information</u>

1. Cooked weight of each ingredient using yield figures provided.

2. Total cost of each ingredient.

3. Total cost of recipe.

4. Cost per serving.

5. Calculated weight of total recipe.

6. Percent difference from estimated total weight. *

7. Calculated weight of serving.

8. Percent difference from estimated weight of serving.*

9. Calculated nutrient (for desired number of nutrients) levels/serving.

*Dr. J. Balintfy used these as an effective checking device to assume "reasonable" recipe information. If recipe is more than 5% out of balance, it is rechecked for validity.

E. <u>Additional Data Considerations for Computer-Assisted Menu Planning</u>.

1. Palatability factor codes color, texture, etc., if the factors are to be used as restraints.

2. Frequency of service limits: each menu item requires a stated minimum number of days or meals that must pass before it is available for use again on menu. A maximum separation may be desirable to assure selection of higher cost items.

3. Dominant flavors - To restrict reoccurrence of certain foods from appearing in different forms, there must be a restriction based on the food item rather than menu item alone. (Example: cabbage may used in cabbage rolls as a vegetable and in cole slaw, therefore, if used in any one form it should be restricted from use for a presented period of time).

4. Starches may be restricted at meals where they are part of the entree.

5. Meal, course and type (e.g., casserole, solid meat, etc.) of menu item require some form of coding.

6. Desired level of nutrients must be stated if a constraint.

7. Type of diet (may be desirable for hospital food service).

8. Preference rating data - alphabetic or numeric term indicating popularity based on surveys of population.

9. Labor and production limitations - inadequately studied at present time to mention in relation to CAMP.

F. <u>Miscellaneous Considerations</u>

1. There may be accessory or sub-assembly recipes that are a part of one particular recipe.

   Example: Tossed Green Salad with:

   (a) cil and vinegar dressing

   (b) thousand island dressing

   (c) French dressing

   Baked Ham with:

   (a) cherry sauce

   (b) raisin sauce

2. Items of free choice

   (a) Tray of relishes - available for random selection.

   (b) Salads with choice of several dressings.

   (c) Free selection of beverages.

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RATIONS, MENUS AND FOOD PLANS

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During the past several years there has been considerable discussion and several articles written about the use of computers to assist the dietitian in menu planning. Usually, the fact that the use of the computer makes it possible for the dietitian to plan the menus well in advance is emphasized. Today I will discuss two subjects; first I will cover Advance Menu Planning, and later on in the program, the Use of the Computer.

Advance Menu Planning is a "must" in the Army Food Service Center operation since the Army menu has been planned 18 months in advance for many years. Why it is necessary for the Army to plan menus so far in advance is best explained by discussing the scope of the use of the Army Master Menu. This one document controls the feeding of almost three-quarters of a million military personnel, or in terms of meals, represents over two and a quarter million meals a day. Based on the requirements for this menu the Defense Personnel Support Center, for example, procures 43 million dozen eggs, 100 million pounds of beef and 16 million pounds of coffee. It is obvious that advance planning is necessary for a program of this magnitude. In addition, these foods must be shipped long distances since the menu is used in many areas of the world. At the present time the Master Menu is used by the Army, not only within the Continental United States but in Japan, Korea, Hawaii, Okinawa, Panama and North Africa. A modified cyclic version of the Master Menu is currently in use in Vietnam.

The basic document that is developed in our office 18 months in advance is what we call an Annual Food Plan. This food plan,(see Figure 1), is a list of all the items that will be included in the menu for the year (about 300 in number), the issue quantity per 100 men per recipe, the frequency of servings per month and the total quantity for each item for the year. In developing the food plan we use a "tool" that is familiar to anyone involved in a menu-planning operation. This tool is the Frequency of Serving Chart.

Figure 2 depicts one page from the Chart and indicates the planned frequency of serving for soups. You can readily see that we plan one serving of soup for almost every day of the year except during the summer months. A similar plan is developed for each component of the menu. Establishing this frequency for each item is a very important aspect in our program and the planned frequency used in our present menus is the result of extensive study over a period of years.

ITEM a	ANNUAL FOOD PLAN (AR 31-20) STOCK NUMBER AND ITEM b	UNIT c	COMMAND UNITS PER 100 d	JAN e	FEB f	MAR g	APR h	MAY i	JUN j	JUL k	AUG l	SEP m	OCT n	NOV o	DEC p	TOTAL NUMBER UNITS q	UNITS PER 1000 RATIONS r	PREPARATION DATE July 1966 UNIT WEIGHT s	POUNDS PER 1000 RATIONS t	QUARTERL[Y] 1ST u	2N[D] v
	8915 - FRUITS AND VEGETABLES (CONT'D)																				
56	8915-616-4820 Beans, green, canned	No.10 can														146 2/3	4.01	6.313	25.32	4.12	4.
	Soup (Minestrone)	No.10 can	1/3	1	1	1	1	1					1	1	1	2 2/3					
	Salad	No.10 can	½		1		1		1		1		1		1	3					
	Vegetable	No.10 can	3	4	4	4	4	4	4	3	4	4	4	4	4	141					
57	8915-128-1176 Beans, green, frozen	lb	12	5	5	5	5	5	5	5	5	5	5	5	5	720	19.67	1.000	19.67		
58	8915-127-9665 Beans, kidney, canned	No.303 can	8	1		1		1		1		1		1		48	1.31	1.000	1.31		
59	8915-530-2182 Beans, kidney, dry Chili Con Carne	lb	8	1	1	1	1	1	1	1	1	1	1	1	1	96	2.62	1.000	2.62	2.64	2.
60	8915-577-4526 Beans, lima, canned	No.10 can	3	2	2	1	1	1	1	1	1	1	1	1	1	42	1.15	6.563	7.55	1.65	
61	8915-127-7984 Beans, lima, frozen	lb														540	14.75	1.000	14.75		
	Vegetable	lb	12	3	2	3	3	3	3	3	3	3	3	3	3	420					
	Succotash	lb	5	2	2	2	2	2	2	2	2	2	2	2	2	120					
62	8915-616-4819 Beans, wax, frozen (w/Other Vegetable)	lb	6	1	1	1		1		1					1	36	.98	1.000	.98		
63	8915-782-6365 Beans, white, canned, w/pork in tomato sauce	No. 3 cyl can	12	2	1	2	1	2	1	2	1	2	1	2	1	216	5.90	3.188	18.81	6.59	5.

Figure 1

ANNUAL FOOD PLAN (AR 31-20)			COMMAND CONTINENTAL UNITED STATES - ARMY AND AIR FORCE															PREPARATION DATE July 1966		FOR	
ITEM a	STOCK NUMBER AND ITEM b	UNIT c	UNITS PER 100 d	JAN e	FEB f	MAR g	APR h	MAY i	JUN j	JUL k	AUG l	SEP m	OCT n	NOV o	DEC p	TOTAL NUMBER UNITS q	UNITS PER 1000 RATIONS r	UNIT WEIGHT s	POUNDS PER 1000 RATIONS t	QUARTERL 1ST u	2NI v
	SOUPS																				
	Bean			2	2	1	1	1				1	2	1	2		Beans, white, dry lb 6				
	Beef Bouillon w/Barley			2	2	2	2	2		1	1		2	2	2		Barley, pearl, 1-lb ct 1½				
	Beef Bouillon w/Noodles			1	1	1	1	1	1	1	1	1	1	1	1		Noodles, lb 1½				
	Beef Bouillon w/Rice			1	1	1	1	1	1	1	1	1	1	1	1		Rice, lb 1½				
	Chicken Noodle (dehy)	No.2½ can	4	2	2	2	2	2	2	2	2	2	2	2	2						
	Cream of Corn			1	1	1											Corn, canned, cream style, N				
	Cream of Tomato					1	1						1	1	1						
	Cream of Mushroom						1	1													
	Creole			1	1	1	1	1					1	1	1		Spaghetti, lb 1½				
	Minestrone			1	1	1	1	1					1	1	1		Spaghetti, lb 1½ Beans, wh Beans, green, canned, No. 10				
	Mulligatawny				1								1		1		Apples, fresh, lb 2 ;(Soup & can				
	Onion (dehy)	No.2½ can	4	1	1	1	1							1	1						
	Oyster Stew			1										1			Oysters, frozen, lb 14				
	Pea (dehy)	No.3 cyl can	2	1	1	1	1	1					1	1	1						
	Pepper Pot			1	1	1	1	1					1	1	1						
	Potato			1	1		1	1					1	1	1						
	Tomato			1	2	1	2	2					1	2	1						
	Tomato Bouillon			1	1	1	1	1					1	1	1		Juice, tomato, canned, No.				

Figure 2

The Master Menu, based on the Food Plan, is prepared in our office seven months in advance, and will be available at all Army installations within the United States four months in advance of the data of serving. Because of the long lead time required to ship food supplies, we forward the manuscript copies six months in advance to our overseas users.

Figure 3 illustrates a typical page from the Master Menu. The Bill of Fare appears at the top of the page. The recipe information below describes the quantity of food required to prepare this menu for 100 men by meal. For example, this day's menu requires 15¼ pounds of butter for the preparation of the three meals for the day. Opposite this page (in the printed menu) is the information used to determine, for example, how much buffer was required.

The chart in Figure 4 provides a listing of the ingredients from each recipe used in the Bill of Fare for the day. It is important to note that the recipes in the Army recipe manual provide for 100 standard size portions, whereas, the menu specifies issue quantities based on what we know from experience 100 men will eat. This latter information performs an important service for our food service personnel. By constantly studying and revising the issue rates, our predicted consumption is quite accurate and a minimum of changes are made at the installation level.

In developing the food plan and in planning the menu the primary factors that must be considered are:

1 - Acceptability

2 - Cost

3 - Availability

4 - Nutritional Value

Acceptability is determined by the use of several methods to furnish feedback information from the field. They are:

1 - Food Preference Surveys

2 - Minutes of the Command and Installation Menu Boards.

3 - Air Force Master Menu Utilization Survey

4 - Demand Data

Tuesday - 4 April 1967

BREAKFAST	DINNER	SUPPER
Chilled Grapefruit Juice	Cream of Mushroom Soup (P-94)	Baked Pork Chops (A-66) [20]
Ala Carte Menu	Crackers	Brown Gravy (O-1)
Pan Broiled Bacon (A-69)	Creole Beef Balls (A-35)	Mashed Potatoes [33]
Cinnamon Raisin Rolls (J-17)	Cottage Fried Potatoes (Q-77)	Buttered Lima Beans (Q-14)
	Corn Pudding (Q-44)	Pickle Relish Cole Slaw (M-62)
	Lettuce Wedge	Bread
	Vinaigrette Dressing (M-99)	Butter
	Bread	Devil's Food Cake [39]
	Butter	Chocolate Butter Cream Frosting [44]
	Chilled Plums	Tea
	Tea	Coffee (R-21)
	Coffee (R-21)	Milk[1]
	Milk[1]	

ISSUE CHART

INGREDIENTS – 100 MEN		UNIT	BREAKFAST	DINNER	SUPPER	TOTAL 1 DAY	COST
PERISHABLE							
MEAT AND MEAT PRODUCTS:	Bacon, slab, chilled	lb	14	--	--	14	
	Beef, carcass, chilled	lb	--	35	--	35	
	Beef, boneless, frozen, ground[2]	lb	--	23	--	23	
	Pork, loin, chilled, bladeless	lb	--	--	55	55	
	Pork, slices, frozen, boned[2]	lb	--	--	32.50	32.50	
DAIRY FOODS AND EGGS:	Butter	lb	4.25	5	6	15.25	
	Eggs, shell	doz	15.50	4.50	1.50	21.50	
	Milk	gal	6.25	--	--	6.25	
FRUITS, FRESH:	Lemons, fresh	lb	--	.25	.25	.50	
VEGETABLES, FRESH:	Cabbage, fresh	lb	--	--	12	12	
	Lettuce, fresh	lb	--	12	--	12	
	Onions, dry	lb	--	.75	--	.75	
	Peppers, sweet, fresh	lb	--	1.63	.67	2.30	
	Potatoes, white, fresh	lb	--	45	--	45	
JUICES, FROZEN:	Juice, grapefruit, frozen, 3 plus 1	32-fl oz can	4	--	--	4	
MISCELLANEOUS	Bread, fresh, white	lb	5	12	12	29	
	Shortening compound	lb	2.13	1.50	1.63	5.26	
NONPERISHABLE							
DAIRY FOODS AND EGGS:	Milk, evaporated	14½-oz can	1	1	1	3	
FRUITS AND VEGETABLES:	Beans, lima, canned	No.10 can	--	--	3	3	
	Corn, canned, cream style	No.303 can	--	20	--	20	
	Mushrooms, canned	8-Z can	--	14	--	14	
	Pimientos, canned	7-oz can	--	--	.67	.67	
	Plums, canned	No.10 can	--	3	--	3	
	Potatoes, white, instant, granules	No.10 can	--	--	1	1	
	Raisins	15½-oz ct	3	--	--	3	
	Tomato paste	No.2½ can	--	3.75	--	3.75	
BAKERY AND CEREAL PRODUCTS:	Cereal, prepared	ct	50	--	--	50	
	Flour, wheat, hard	lb	10	2	1.13	13.13	
	Flour, wheat, soft	lb	--	--	3	3	
	Rice parboiled	lb	--	3	--	3	
SUGAR, CONFECTIONERY AND NUTS:							
	Sugar, brown	1-lb ct	2	--	--	2	
	Sugar, refined, granulated	lb	6.25	1.88	5.75	13.88	
	Sugar, refined, powdered	1-lb ct	3	--	4.75	7.75	
COFFEE, TEA AND COCOA:	Cocoa	1-lb ct	--	--	1.38	1.38	
	Coffee, roasted	lb	3	2	2	7	

See page 70 for menu notes.

Figure 3

Tuesday - 4 April 1967

BREAKFAST

INGREDIENTS	UNIT	NUMBER
CHILLED GRAPEFRUIT JUICE		
Juice, grapefruit, frozen, 3 plus 1	32 fl oz can	4
PAN BROILED BACON		
Bacon, slab, chilled	lb	14
CINNAMON RAISIN ROLLS		
(Yeast, Baker's, active dry	oz	8)
(Water for yeast	cup	1)
(Milk, nonfat, dry	oz	4-3/4)
(Water, cold	cups	6½)
Eggs, shell	doz	1½
Sugar, refined, granulated	lb	1-3/4
(Salt, table	tbsp	4½)
Shortening compound	lb	1-5/8
Flour, wheat, hard	lb	10
Filling:		
Butter (melted)	lb	1
(Cinnamon, ground	tbsp	5)
Sugar, brown	1-lb ct	2
Raisins	15½-oz ct	3
Icing:		
Butter	lb	½
(Salt, table	tsp	¼)
Sugar, refined, powdered	1-lb ct	3
(Flavoring, imitation vanilla	tbsp	1)
(Water, boiling (variable)	cup	1)

DINNER

INGREDIENTS	UNIT	NUMBER
CREAM OF MUSHROOM SOUP		
Mushrooms, canned	8Z can	14
Onions, dry	lb	3/4
Butter	lb	2
Flour, wheat, hard	lb	2
(Pepper, black, ground	tsp	2)
(Salt, table	tbsp	6)
(Chicken stock or water	gal	4)
(Milk, nonfat, dry	lb	3½)
(Water	gal	1-3/4)
(CRACKER, SODA, SALTED		)
CREOLE BEEF BALLS		
Beef, carcass, chilled or	lb	35
Beef, boneless, frozen, ground	lb	23
Eggs, shell	doz	2½
(Onions, dehydrated, sliced	oz	2½)
(Salt, table	oz	6)
Rice, parboiled	lb	3
(Pepper, black, ground	tsp	2)
Peppers, sweet, fresh	lb	1½
(Garlic, dry	oz	½)
Sauce:		
Tomato paste	No. 2½ can	3-3/4
(Water	gal	1½)
(Salt, table	oz	4)
COTTAGE FRIED POTATOES		
Potatoes, white, fresh	lb	45
Shortening compound	lb	1½
(Salt, table	oz	3)
(Pepper, black, ground	tsp	1½)
CORN PUDDING		
Corn, canned, cream style	No. 303 can	20
(Salt, table	tbsp	4½)
Sugar, refined, granulated	lb	1/8
(Pepper, black, ground	tsp	½)
(Milk, nonfat, dry	oz	6½)
(Water	cups	7½)
Eggs, shell	doz	2
(Bread, soft, broken	qt	2½)
LETTUCE WEDGE		
Lettuce, fresh	lb	12
VINAIGRETTE DRESSING		
(Mustard, ground	tsp	1½)
(Pepper, black, ground	tsp	1½)
(Pepper, cayenne, ground	tsp	½)
(Salt, table	oz	2½)
(Sugar, refined granulated	oz	1)
(Water	oz	4)
(Onions, dry	oz	1-3/4)
(Parsley, fresh	oz	1)
Peppers, sweet, fresh	lb	1/8
(Pickles, cucumber, sweet, whole	lb	1/8)
(Salad oil	qt	1¼)
(Vinegar, cider or wine	1-qt btl	½)
BREAD, FRESH, WHITE	lb	12
BUTTER	lb	3
CHILLED PLUMS		
Plums, canned	No. 10 can	3
(TEA		
Lemons, fresh	lb	¼
COFFEE, ROASTED	lb	2
Sugar, refined, granulated	lb	1-1/4
Milk, evaporated	14½-oz can	1

SUPPER

INGREDIENTS	UNIT	NUMBER
BAKED PORK CHOPS		
Pork, loin, chilled, bladeless or	lb	55
Pork, slices, frozen, boned	lb	38½
(Salt, table	lb	½)
(Pepper, black, ground	oz	¼)
BROWN GRAVY		
(Clear fat, from drippings	qt	3/4)
Flour, wheat, hard	lb	1-1/8
(Garlic, dry	clove	1)
(Stock	gal	2)
(Salt, table	oz	3)
(Pepper, black, ground	oz	¼)
MASHED POTATOES		
(Water	qt	10½)
(Milk, nonfat, dry	oz	12)
(Water	qt	3)
(Salt, table	tbsp	4½)
Butter	lb	1
(Pepper, black, ground	tsp	1½)
Potatoes, white, instant, granules	No. 10 can	1
BUTTERED LIMA BEANS		
Beans, lima, canned	No. 10 can	3
Butter	lb	3/4
(Pepper, black, ground		)
PICKLE RELISH COLE SLAW		
Cabbage, fresh	lb	12
Peppers, sweet, fresh	lb	2/3
Pimientos, canned	7-oz can	2/3
(Relish, pickle, sweet	qt	½)
(Pepper, black, ground		)
(Salt, table	oz	2)
(Sugar, refined, granulated	oz	2½)
(Salad dressing	qt	3/4)
BREAD, FRESH, WHITE	lb	12
BUTTER	lb	3
DEVIL'S FOOD CAKE		
Flour, wheat, soft	lb	3
Sugar, refined, granulated	lb	4
(Salt, table	tbsp	2¼)
(Baking soda	tbsp	4½)
Cocoa	1-lb ct	5/8
(Milk, nonfat, dry	oz	6)
Shortening compound	lb	1-5/8
(Water	cups	4-1/3)
Eggs, shell	doz	1½
(Vinegar, cider or wine	cup	¼)
(Water	cups	1-3/4)
(Flavoring, imitation, vanilla	tbsp	4)
CHOCOLATE BUTTER CREAM FROSTING		
Butter	lb	1¼
Sugar, refined, powdered	1-lb ct	4-3/4
(Salt, table	tsp	1)
(Milk, nonfat, dry	oz	1)
Cocoa	1-lb ct	3/4
(Water, boiling	cups	1-3/4)
(Flavoring, imitation, vanilla	tbsp	2)
(TEA		)
Lemons, fresh	lb	¼
COFFEE, ROASTED	lb	2
Sugar, refined, granulated	lb	1-3/4
Milk, evaporated	14½-oz can	1

Figure 9

The food preference surveys are conducted periodically. These surveys solicit the opinion of a random-selected sample of soldiers as to how well they like or dislike a selected list of foods. The number of foods included in each survey is usually about 200, but each soldier does not rate the entire list. These surveys have been conducted periodically since 1955.

The minutes recording the changes made to the menu each month by approximately 70 command or installation menu boards, are forwarded to our office. We receive and analyze the changes and any other comments made. Just prior to developing the food plan each year, the changes are compiled into the Annual Report to be used to assist the dietitians in developing the next year's food plan.

Each year the Air Force forwards to each Air Force Base using the Master Menu, a list of questions relative to the Menu. The questions could be on any aspect such as acceptability of items, on recipes and adequacy of issue quantity; questions as to quality of the food or food service equipment may also be included.

The cost of the Master Menu is determined by what we term the Garrison Ration. This ration is a list of 39 food items with weighted quantities per man per day, which serves as a price index. These 39 items are costed monthly using current price lists as shown in Figure 5. The menu prepared during this period must be within the value of these 39 items. The printed menu at each installation establishes the value of the ration at that installation. For costing and requisitioning purposes, the total monthly requirements are compiled by meal in a document called the Recapitulation of Master Menu issues.

The document shown in Figure 6 is used by commissary personnel for costing and ordering. (The current food cost of the menu per man per day is $1.02.) Another factor is availability. It is obvious that any item used in the food plan and menu must be available in large quantities and be in national distribution. In addition, we must be sure that we are planning to serve the foods when the quantity is best and the price most economical. Our procurement experts review the food plan each year for this purpose.

GARRISON RATION FACTOR EQUIVALENTS

AR 30-40 COMPONENT ITEM	AR 30-40 COMPONENT ITEM ALLOWANCE (PER MAN)	IN BULK EQUIVALENT	UNIT OF ISSUE	IN BULK (100 RATIONS) QUANTITY (PER UNIT OF ISSUE)	UNIT PRICE	TOTAL PRICE
Apples, canned	1.50 oz	Apples, canned No.2 or No.10	can can	8.3333 1.5625		
Bacon	2.00 oz	Bacon, slab, chilled	lb	12.5000		
Baking powder	.09 oz	Baking powder 1-lb	can	.5625		
Beans	.50 oz	Beans,wht,dry 10-100 lb bag	lb	3.1250		
Beans String,canned	3.00 oz	Beans,green,canned No.10 or No.303	can can	2.9701 19.3498		
Beef, fresh	10.00 oz	Beef,carcass Eq Frs & Hds or Boneless	lb lb	62.5000 40.5000		
Butter	2.00 oz	Butter 1-lb print	lb	12.5000		
Cheese	.25 oz	Cheese, cheddar, natural	lb	1.5625		
Chicken, fresh	2.00 oz	Chicken,roasters,RTC,whole	lb	9.3750		
Cinnamon	.014 oz	Cinnamon,ground 3-4 oz or 1-lb	cc cc	.3995 .0875		
Cocoa	.30 oz	Cocoa 1-lb	ct/can	1.8750		
Coffee	2.00 oz	Coffee,roasted 2-3-20 lb can	lb	12.5000		
Corn, canned	2.00 oz	Corn, cream style No.303	can	12.5000		
Eggs, fresh	1 each	Eggs, shell	doz	8.3333		
Flavoring Ext	.02 oz	Flavoring extract 8 oz	btl	.2500		
Flour, wheat	12.00 oz	Flour, wheat, hard 10-50-100 lb bag or 10-50-100 lb bag and Bread purchased	lb lb lb	75.0000 25.0000 50.0000		
Jams or Preserves	.50 oz	Jam, strawberry No.2½	can	1.3511		
Lard	.64 oz	Lard	lb	4.0000		
Lard substitute	.64 oz	Shortening compound 1-lb ct or 5½-lb can or 5-gallon can	lb can can	4.0000 .7273 .1212		
Macaroni	.25 oz	Macaroni 9-lb ct	lb	1.5625		
Milk,evaporated	1.00 oz	Milk,evaporated 14½ oz	can	6.8966		
Milk, fresh	3.00 oz	Milk, fresh or pint or quart or gallon	½ pt pt qt gal	100.0000 50.0000 25.0000 6.2500		
Onions	2.00 oz	Onions, dry	lb	12.5000		
Peas, canned	2.00 oz	Peas, canned No.303 or No.10	can can	12.5000 1.9046		
Peaches, canned	1.20 oz	Peaches, canned No.2½ or No.10	can can	4.1368 1.1111		
Pepper, black	.04 oz	Pepper, black 3-4 oz or 1-lb	cc can	1.1416 .2500		
Pickles, cucumber	.16 oz	Pickles,cucumber,sweet No.10	can	.2207		
Pineapple, canned	1.20 oz	Pineapple, canned, slices No.2½ or No.10	can can	4.0000 1.1111		
Pork, fresh	4.00 oz	Pork ham	lb	25.0000		
Potatoes	10.00 oz	Potatoes, white, fresh	lb	62.5000		
Prunes	.30 oz	Prunes,evaporated 1-lb ct or dried,canned No.10	ct can	1.8750 .3946		
Rice	.60 oz	Rice,parboiled 10-50 lb bag	lb	3.7500		

USAFSC FORM REV 29 JUNE 66 25-211 PREVIOUS EDITIONS ARE OBSOLETE

Figure 5

PERISHABLE

RECAPITULATION OF MASTER MENU ISSUES

ITEM	UNIT	M E	Sat 25	Sun 26	27	28	29	30	31	Sat 1	Sun 2	3	4	5	6	7	Sat 8	Sun 9	10	11	12	13
MEAT, POULTRY AND FISH																						
Meat and Meat Products:																						
8905-551-9908 Bacon, slab, chilled	lb	B	14	14		14			14	14		14	14	14		14	14		14	14		
		D	1.25				1				1				7.50				1.75			
		S										.50						6	1		1	
Beef, carcass, chilled (ARMY)	lb	B						35														
		D	60				45		60	35			35				45	60		45		
		S		45	35	60					45	60		45	60	35			35			60
OR																						
8905-127-6556 Beef, boneless, frozen 1/ (AIR FORCE)	lb																					
Grill steaks	lb	D																				
		S													47							
Swiss steaks	lb	S				38																38
Oven roasts	lb	D	39															39				
		S										39										
Pot roasts	lb	D							39											39		
		S																				
Diced	lb	S		30							30											
Ground	lb	B						20														
		D					30			23			23				30					
		S			23									30		23			23			
8905-965-4719 Beef, dried, chilled	lb	B																			7	
8905-285-2075 Beef, ground, frozen	lb	D								7												
		S														8						

1/ For use by Army installations not serviced by a Central Meat Processing Facility.

2/ This item is also authorized for use at Army installations with Central Meat Processing Facilities if they so desire.

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PREVIOUS EDITIONS ARE OBSOLETE

Figure 6

The nutritional values that must be met are prescribed by regulation by the Army Surgeon General. The Surgeon General in turn bases his recommendations on those of the National Research Council. We use food composition tables especially prepared for the military by the U.S. Department of Agriculture. Currently the menu includes approximately 4,000 calories and an adequate amount of other nutrients.

As shown in Figure 7, the menu is balanced each day for caloric value. We attempt to keep each day's menus within a caloric range of 3800 to 4100 calories.

Other factors which must be considered in the development of the food plan are as follows:

1. Food used must be restricted to the authorized items as reflected in the Federal Stock Catalog.

2. Foods must have adequate stability.

3. Non-perishable items that are stockpiled for emergency use must be incorporated.

We have still other requirements that must be considered in the development of the Master Menu. In addition to the usual factors such as acceptable foods and attractive color combination, we have factors which may or may not be peculiar to Army food service that come into play. These factors include the scheduling of a "more" acceptable meat and one "less" acceptable meat each day, alternating between the dinner and supper meals. The equipment and storage capabilities available in the messes must be considered, the degree of training of our food service personnel and the programming of the meat to conform to how it is processed and issued. Carcass meats are used extensively by the Army within the Continental United States. Therefore, the factors surrounding the use of carcass meats must be given consideration in the development of the Master Menu. An example of this is the way in which a carcass beef cycle must be programmed in the menu on three consecutive days. For all installations and oversea commands utilizing boneless beef, the six components of the boneless product must be programmed for menu use in the same percentages which are supplied in accordance with the military specification. This requirement is also applicable to veal and lamb products. Practical examples of the menu

	* As computed
Calories	3,900
Protein (gm)	122
Fat (gm)	180
Calcium (mg)	1,025
Iron (mg)	23.4
Vitamin A (IU)	13,135
Thiamine (mg)	2.0
Riboflavin (mg)	2.6
Niacin (mg)	27
Ascorbic Acid (mg)	118

Figure 7

planning rules that must be followed because of the use of carcass meats processed in our own facilities are illustrated below:

1. Beef cycles (three consecutive days or meals) may be started at any meal except Sunday night and Monday noon.

2. If beef cycle is started on Monday night, it must be a roast.

3. If beef cycle starts on Friday and Saturday, the Sunday meal must be diced beef.

4. Beef will not be scheduled for evening meals on holidays.

5. Veal and lamb cycles must start on Wednesdays.

6. Any menu change involves three meals for beef and two for lamb and veal.

7. Lamb and veal cycles must always be served on two consecutive days at the same meal.

In addition to the menu planning guides that we follow for meats, we have other rules that we follow that may or may not be peculiar to the military. Other examples of these are:

1. Citrus fruit or tomatoes must be served once a day.

2. Cream pies, poultry salads or scallops cannot be served in the summer months.

3. Avoid including more than one item on the menu that will create a garbage problem, e.g., corn-on-the-cob and watermelon.

4. Do not schedule pie on Sunday or Monday noon.

5. Never serve cold cuts at a noon meal.

6. All recipes included in a menu must be checked for repetition of a common ingredient. Examples of items likely to be repeated are onions, tomatoes, lemons, fruit and strong juice vegetables.

There are many more special requirements too numerous to cite here. We have literally dozens of examples of menu combinations that experience has indicated are objectionable to our customers, and then again, many examples of combinations that are traditional and must not be changed. All of these special considerations, however, will, if we are to convert to the use of a computer for planning the menu, be programmed into the machine. Today most of this type of information regarding our Menu Planning Program is either brought to the job by the dietician by her education and training, or is learned on the job through experience. The use of computers to perform this menu planning function will be a radical departure for us. But we do not feel reluctant to change, or have we fear that we will be replaced by a mechanical robot. Instead, we view this as a challenge and a step forward in improving our program.

EDP COMPUTATION OF THE MASTER MENU
FROM THE AIR FORCE ANNUAL FOOD PLAN

Mrs. G.G. Gotschall
Air Force Service Office (AFLC)
Philadelphia, Pennsylvania

Some of the people attending this Conference may not be familiar with an Annual Food Plan and its role in the Air Force Food Program. I will take a few minutes before explaining our computer program to give a brief description of an Annual Food Plan and its relationship to the Air Force Food Program. An Annual Food Plan is a document which lists every food item from meats to spices to be used in a calendar year. It also shows the number of units (which may be expressed as jars, cans, bottles, lbs., etc.) per 100 men each time a particular food item is issued. We call this the "Issue Rate." In addition, it shows the exact number of servings for each month of the year for each food item; our name for this is "Frequency of Serving." As well as showing the exact number of servings for each month, it also reflects how the item is to be used for future menu planning purposes. For example, "Apples, Fresh" will be shown as a breakfast fruit with its comparable issue rate (the number of lbs. per 100 men), the number of servings and the actual months planned to serve fresh apples for breakfast. It also may show fresh apples for use in fresh fruit cup as an appetizer, a mixed fresh fruit salad, a Waldorf salad, a special issue for holidays (Thanksgiving and Christmas) and probably show apples for a dessert fruit. Each use of apples has its own issue rate and frequency of serving, and all of this is found on the Annual Food Plan. By multiplying the number of servings times the issue rate we show the total number of units (lbs., cans, jars, etc.) that will be required to feed 100 men, for one calendar year for each food item.

The Annual Food Plan is prepared 18 months in advance. For example, the FY 69 Annual Food Plans will be published in July 1967, and the preliminary work is already in process. The Army and Air Force co-author a CONUS Annual Food Plan; in addition, the Air Force has five overseas Annual Food Plans which cover the five areas of the world where the Air Force has been given the logistical responsibilities. We have one Food Plan for the northern climates which supports all Army and Air Force installations located in Greenland, Labrador, some small sites in Newfoundland, and Alaska. In addition, we have Food Plans for each of the following: One for the Azores, Bermuda and Spain; one for Turkey, the Middle East and Libya; one for the United Kingdom; and one for the Philippines and Guam. There are discussions now underway regarding the possibility of adding the Air Force installations located in Taiwan to the Philippines and Guam Food Plan.

There are two reasons why each area has its own Food Plan. The first is the level of reserve stocks that is required to be on-hand at all times, and which varies from area to area. One-third of the stock is to be rotated each year, and this rotation is planned in the Annual Food Plan and affects the number of servings of comparable perishable and nonperishable items served in each area. The second reason is the local availability of fresh produce and the varying times of the year that they are available. We try to take full advantage of local items when and where we are permitted. This affects the number of servings of comparable perishable and nonperishable items to be requisitioned from the States.

After the Annual Food Plan has been completed, the next step is to develop the Ration Factor, which is the number of pounds of a food item that will feed 1000 men for one day. There are two types of Ration Factors: the Annual Factor and the Monthly Factor. An Annual Ration Factor is computed when a food item is served 10-12 months of the year. To compute an Annual Ration Factor, the total number of units per year is first converted to total pounds per year. Next, the yearly total pounds per 100 men is multiplied by 10 to get the total pounds per 1000 men per year, and then divided by 365 (the number of days in the year) to get the number of pounds required to feed 1000 men for one day.

The Monthly Ration Factor is applied primarily to those items that are served less than 10 months of the year. The only difference is that instead of dividing by 365, we divide by the sum of the number of days in the months the item is to be served. For example, if an item was planned to be served in May, June, July and August, the divisor would be 122 instead of 365. The Monthly Ration Factor is used by the overseas requisitioners to order from the overseas supply agencies in the States.

The Air Force has three dietitians overseas who are responsible for the preparation of their respective area Annual Food Plans. We have a dietitian in the Philippines who prepares the Philippine and Guam Annual Food Plan, one in England who prepares the United Kingdom Food Plan and one in Ankara, Turkey who prepares the Turkey, Middle East and Libya Food Plan. The Food Plans for the Northern Area and for the Azores, Bermuda and Spain, are prepared by two of the dietitians in the Air Force Services Office. Our office has the responsibility of approving all Air Force overseas Food Plans.

Prior to 1963, all analyzing of the Food Plans was done manually, and they were costed to ensure that they were within the authorized monetary allowance. All items were checked to be sure they were within authorization, and a nutritional computation was made on each Food Plan to assure that the menus that were to be planned from it would be within the nutritional limitations established by the Air Force Surgeon General. After all these computations were completed, the Food Plan could be approved. The next step was to compute the Ration Factors. Because the majority of the analyses was in the form of mathematical computation, it was determined that the entire food plan was adaptable to a computer program. During 1962, a comprehensive analysis of the entire program was made. This study included machine time and capability, man-hour requirements and feasibility.

In early 1963, the Annual Food Plan program was assigned to the RCA 301 computer, which was magnetic tape oriented with a 10,000 character memory unit. The use of the computer made possible ultimate expansion of the program to include additional management documents. The Food Plan program was established under the following guidelines. A Master Tape would carry all the supply data required with each item plus the nutritional values for one pound of the food item. Each item was assigned a five-digit identification number. On the Master Tape you will find the item number, the federal stock number, the nomenclature, the unit of issue (lb., can, jar, etc.), the conversion factor (the weight of one unit), the perishability status (perishable or non-perishable), the source of supply (as identified in the Federal Supply Catalog), a compare item number, which is used to develop one of the documents, and the nutritional values for calories, protein, fat, calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C. Each Food Plan for the oversea areas covers many requisitioning agencies, and therefore each agency was assigned a code number. We have a total of 25 separate agencies.

The detailed information from each food plan was put on a second tape and identified by agency. The input to this Detail Tape is received from the overseas dietitians and the two dietitians in my office.

The Annual Food Plan Form was redesigned to be compatible with the 80-column keypunch card. The input from the overseas dietitians is reviewed by one of my dietitians for accuracy, necessary corrections are made, and then the data is key-punched. The cards are used to update the Detail Tape. At the same time, the Master Tape may also be updated to add new items, change any of the remaining data, or delete old items. From the merging of the Master Tape and the Detail Tape, we get an Annual Food Plan for each of the 25 agencies. We are currently in the process of refining this step so we will get five consolidated frequencies in line with our five Annual Food Plans.

Since we are interested in the cost of the Annual Food Plan, the next report is the cost analysis. (I will not go into detail on each and every report as I brought samples with me which I am prepared to leave with you). In essence, the cost analysis gives us the unit cost per item, the total cost per item, a subtotal for each food group and a grand total based on 100 men per year. It also gives us the cost per man per day. Our cost allowance is presently governed by the cost of the Garrison Ration (the 39 components), which is also on tape, and a report for each agency tells us our cost allowance. A 5% variation is also allowed. If an area is required to maintain a stock reserve and these are rotated in the Food Plan, the canned meats and dehydrated foods that are part of this stock are included on a third report and also costed. The reason for this is that canned meats and dehydrated foods cost more, in most cases, than their perishable counter-parts. We are authorized to add this additional cost to our Garrison Ration cost to arrive at our total authorized allowance. A fourth report is the cost of the comparable perishable items that are being replaced by the canned meats and dehydrated foods. The computer compares the two reports, prints out the difference, and stores the information for a later report which we use as a cost comparison report. On the printout we have, by agency, the cost of the Annual Food Plan, the cost of the Garrison Ration, the cost of the canned meats and dehydrated foods, the cost of their perishable counterparts, the total authorized monetary allowance, and a final figure which tells us if the cost of the Annual Food Plan is over or under the authorized allowance.

At this point we must stop the computers, take a look at our Food Plans, make necessary changes and start the cycle all over. Once our Food Plans are within the cost allowance, we proceed with the nutritional analysis and the Ration Factor listings. The nutritional analysis, our seventh report, is by agency as are our other reports. The eighth report, our Ration Factor listing, is given to us in three methods. The first is by the individual agency divided into a perishable and non-perishable section. The second method is a consolidation by Food Plan area, and the third is a grand consolidation of all areas. The first method, by agency, is sent to the respective overseas requisitioner, while the second, consolidation by Food Plan area, is sent to the respective overseas headquarters who have the responsibility for that particular area. The third, the grand consolidation, is kept in our office for future management as well as to provide to DPSC certain information for future procurements.

I hope this information may be of some help in determining the feasibility of developing a menu by computer. One word of caution, based on past experience: be sure to provide for as many situations as possible. It's a great deal more complicated to reprogram than to develop a flexible system at the beginning; in short, do it right from the start.

In closing, I would like to bring to your attention a system in operation at Wright-Patterson AFB called a Simulator System. Just last Thursday I attended a briefing on this system, which is designed for managers who want to test out new programs. It requires a very simple language which can be learned quickly and does not require a special programmer. I understand this is the only system of its type in the Department of Defense, and I asked if it were available to departments other than the Air Force. The answer was "yes." You may be interested in checking into this system, and it is possible the Simulator can help you determine if a menu computer program is feasible.

EDP COMPUTATION OF MONTHLY REQUIREMENTS, NUTRITIVE VALUE AND COSTS FROM MASTER MENU

Miss Marion Bollman
U.S. Army Food Service Center Office
Chicago, Illinois

For many years, the entire process of preparing manuscripts for the publication of the Master Menu has been, for the most part, a manual one. The process is slow and tedious, requiring many hours of work for our statistical clerks and typists. Meeting our printing deadline is a constant struggle and any prolonged illness of our clerical staff creates a significant crisis. Since everywhere you turn today, there is talk about the mountains of work being done by electrical accounting machines and high speed computers, it is no wonder that we too turned to Automatic Data Processing (ADP) to help us. We approached the use of ADP as a means of performing the many routine clerical tasks involved in producing the monthly Master Menu and its companion document, the Recapitulation of Master Menu Issues. It now requires approximately three to four working days for a dietitian to plan the menu for a month. It requires, however, almost the full time of three statistical clerks to perform the clerical details and computations involved. Through the use of Automatic Data Processing equipment we will no longer be required to accomplish these tasks in a long and tedious manner. A quick review of the manual process will give you a better understanding of what was involved.

The dietitian planned the menu using a form called a "menu planner," as shown in Figure 1. The caloric value of each recipe was then recorded by the statistical clerk on this menu planner. The dietitian made any adjustments necessary to bring each day's menu within the 3800 to 4000 caloric limitation, if possible. This menu was then typed for review by the Joint Army-Air Force Master Menu Board (see Figure 2).

The changes desired by the Board were annotated and the menu was given to the typist. She normally typed the "bill of fare" portion (see Figure 3), and then utilized a form of mechenized system for the typing of the recipe ingredients.

The mechanized system that I refer to incorporates a Flexowriter electric typewriter which automatically types information contained on edge-punched cards. Even using this mechanized system, it takes a skilled typist 5 full days to produce the ingredient chart for one month's Master Menu. Continuing with the next phase in preparing the menu, a manual posting of all items shown on the ingredient chart must be transferred to the daily issue charts (see Figure 4).

These quantities are then posted to the Recapitulation Manuscript (see Figure 5). Even though we have well-qualified

RATION

7 DAY MENU PLANN

	Sunday	Rec. No.	Cal-ories	Monday	Rec. No.	Cal-ories	Tuesday	Rec. No.	Cal-ories	Wednesday
BREAKFAST										
	TOTAL			TOTAL			TOTAL			TOTAL
DINNER	Soup			Soup			Soup			Soup
	Crackers	5-24	30	Crackers	5-24	30	Crackers	5-24	30	Crackers
	Dressing			Dressing			Dressing			Dressing
	Bread	5-4	147	Bread	5-4	147	Bread	5-4	147	Bread
	Butter	5-56	97	Butter	5-56	97	Butter	5-56	97	Butter
	Tea	7-4		Tea	7-4		Tea	7-4		Tea
	Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee
	Milk	7-2		Milk	7-2		Milk	7-2		Milk
	TOTAL			TOTAL			TOTAL			TOTAL
SUPPER	Soup			Soup			Soup			Soup
	Crackers	5-24	30	Crackers	5-24	30	Crackers	5-24	30	Crackers
	Dressing			Dressing			Dressing			Dressing
	Bread	5-4	147	Bread	5-4	147	Bread	5-4	147	Bread
	Butter	5-56	97	Butter	5-56	97	Butter	5-56	97	Butter
	Tea	7-4		Tea	7-4		Tea	7-4		Tea
	Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee
	Milk	7-2		Milk	7-2		Milk	7-2		Milk
	TOTAL			TOTAL			TOTAL			TOTAL
	DAY'S TOTAL			DAY'S TOTAL			DAY'S TOTAL			DAY'S TOTAL

ASC Form 25-210, Revised 5 Mar. 65

Previous Editions M

Figure

A

DAY MENU PLANNER **PERIOD: FROM ____________ 19____ TO: ____________ 19____**

Wednesday	Rec. No.	Calories	Thursday	Rec. No.	Calories	Friday	Rec. No.	Calories	Saturday	Rec. No.	Calories
TOTAL			TOTAL			TOTAL			TOTAL		
Soup			Soup			Soup			Soup		
Crackers	5–24	30	Crackers	5–24	30	Crackers	5–24	30	Crackers	5–24	30
Dressing			Dressing			Dressing			Dressing		
Bread	5–4	147	Bread	5–4	147	Bread	5–4	147	Bread	5–4	147
Butter	5–56	97	Butter	5–56	97	Butter	5–56	97	Butter	5–56	97
Tea	7–4		Tea	7–4		Tea	7–4		Tea	7–4	
Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee	R-21/2	36
Milk	7–2		Milk	7–2		Milk	7–2		Milk	7–2	
TOTAL			TOTAL			TOTAL			TOTAL		
Soup			Soup			Soup			Soup		
Crackers	5–24	30	Crackers	5–24	30	Crackers	5–24	30	Crackers	5–24	30
Dressing			Dressing			Dressing			Dressing		
Bread	5–4	147	Bread	5–4	147	Bread	5–4	147	Bread	5–4	147
Butter	5–56	97	Butter	5–56	97	Butter	5–56	97	Butter	5–56	97
Tea	7–4		Tea	7–4		Tea	7–4		Tea	7–4	
Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee	R-21/2	36	Coffee	R-21/2	36
Milk	7–2		Milk	7–2		Milk	7–2		Milk	7–2	
TOTAL			TOTAL			TOTAL			TOTAL		
DAY'S TOTAL			DAY'S TOTAL			DAY'S TOTAL			DAY'S TOTAL		

Previous Editions May Be Used

GFO 818-C33

B

Figure 1

JULY 1966 MASTER MENU

July - 1966
Saturday - 16
TOTAL CALORIES - 3903

BREAKFAST - 987

Chilled Grapefruit Juice
Ala Carte Menu
Grilled Ham 131

DINNER - 1638

Swedish Meat Balls (A-46) 491 or Beef Pot Roast (A-3) 451
Oven Browned Potatoes
Pickled Beets
Cauliflower au Gratin
Chef's Salad
Piquante French Dressing
Bread Butter
Cherry Pie
Iced Tea Coffee

SUPPER - 1308

Barbecued Chicken (A-103) 446
Mashed Potatoes (D)
Green Beans and Bacon
Individual Fruit Salad (bananas,apricots,p'apple) on Lettuce
Fruit French Dressing
Bread Butter
Ice Cream
Lemonade

Sunday - 17
TOTAL CALORIES - 4094

BREAKFAST - 987

Chilled Orange Juice
Ala Carte Menu
Pan Broiled Bacon (A-65) 124

DINNER - 1687

Grilled Steak (A-11) 432
Brown Mushroom Gravy
French Fried Potatoes
Scalloped Corn
Lettuce Wedge
Lamaze Dressing
Bread Butter
Devil's Food Cake
Chocolate Butter Icing
Tea Coffee

SUPPER - 1420

Vegetable Beef Soup
Crackers
Sliced Bologna, Luncheon Loaf, New England Style Sausage, Salami and Cheese 394
Mustard
Kidney Bean Salad
Assorted Relish Tray (celery, gr olives, lettuce, sw pickles)
Bread Butter
Fresh Peaches
Sugar Cookies
Limeade

Monday - 18
TOTAL CALORIES - 3836

BREAKFAST - 932

Chilled Tomato Juice
Ala Carte Menu
Grilled Bacon (A-65) 124
Raisin Toast

DINNER 1425

Roast Pork (A-83) 425
Brown Gravy
Buttered Sweet Potatoes
Simmered Greens w/Hard Cooked Eggs
Grapefruit Gelatin Salad
Salad Dressing
Hot Cornbread Butter
Ice Cream
Orangeade

SUPPER - 1479

Meat Loaf (A-39) 422
Brown Gravy
O'Brien Potatoes
Buttered Peas
Garden Vegetable Salad
Sour Cream Dressing
Bread Butter
Apple Pie (D)
Iced Tea Coffee

Figure 2

Thursday - 2 February 1967

BREAKFAST

INGREDIENTS	UNIT	NUMBER
CHILLED TOMATO JUICE		
Juice, tomato, canned, 3 plus 1	36-oz can	4
HOT OATMEAL		
Cereal, rolled oats	20-oz ct	2
(Salt, table	tbsp	1½)
(Water, boiling	qt	8-1/3)
Butter	lb	1/8
Sugar, refined, granulated	lb	2½
GRILLED BACON		
Bacon, slab, chilled	lb	14
RAISIN TOAST		
Bread, fresh, raisin	lb	6

DINNER

INGREDIENTS	UNIT	NUMBER
PEA SOUP		
Soup, dehydrated, green pea	No. 3 cyl can	2
(Water, cool	gal	3)
(CRACKER, SODA, SALTED		)
VEAL FRICASSEE		
Veal, sides, chilled	lb	45
(Shortening compound	lb	2½)
(Stock or water	gal	2½)
(Salt, table	lb	½)
(Pepper, black, ground	oz	½)
Onions, dry	lb	5
Celery, fresh	lb	3
Carrots, fresh	lb	3
Flour, wheat, hard	lb	2
Shortening compound	lb	1
BRAISED VEAL STEAK		
Veal, boneless, frozen, flaked steak	lb	32
(Salt, table	oz	2½)
(Pepper, black, ground	oz	½)
Butter (melted)	lb	1
MASHED POTATOES		
Potatoes, white, fresh	lb	45
(Water, boiling	gal	2½)
(Salt, table	cup	3/4)
(Milk, nonfat, dry	oz	14½)
(Water	qt	4½)
Butter	lb	1
(Salt, table	lb	1/8)
BUTTERED CARROTS		
Carrots, fresh	lb	12
(Water, boiling	qt	1½)
(Salt, table	oz	2½)
(Sugar, refined, granulated	oz	2)
Butter	lb	½
(Salt, table	oz	½)
(Sugar, refined. granulated	oz	1)
PICKLE RELISH COLE SLAW		
Cabbage, fresh	lb	12
Peppers, sweet, fresh	lb	2/3
Pimientos, canned	7-oz can	2/3
(Relish, pickle, sweet	qt	½)
(Pepper, black, ground		
(Salt, table	oz	2)
(Sugar, refined, granulated	oz	2½)
(Salad dressing	qt	3/4)
BREAD, FRESH, WHITE	lb	12
BUTTER	lb	3
STRAWBERRY SHORTCAKE		
Strawberries, frozen	lb	20
Shortcake:		
Flour, wheat, hard	lb	6
(Baking powder	oz	5½)
(Salt, table	tbsp	2)
Sugar, refined, granulated	lb	1
Shortening compound	lb	2-1/8
(Milk, nonfat, dry	oz	6½)
(Water	cups	7½)
Butter	lb	1
Topping:		
(Water, cold	cups	7½)
Topping, dessert and bakery products, dehydrated	1-lb can	2
(Milk, nonfat, dry	oz	7)
Sugar, refined, granulated	lb	½
(Flavoring, imitation, vanilla	tbsp	4)
(TEA		)
Lemons, fresh	lb	½
COFFEE, ROASTED	lb	2
Sugar, refined, granulated	lb	1-3/4
Milk, evaporated	14½-oz can	1

SUPPER

INGREDIENTS	UNIT	NUMBER
BAKED HAM		
Ham, smoked, chilled	lb	52
or		
Ham, cooked, chilled, smoked, boneless	lb	30
(Cloves, whole	oz	1)
Sugar, brown	1-lb ct	3
(Vinegar, cider or wine	1-qt btl	1½)
(Bread crumbs, dry	qt	½)
HAWAIIAN SAUCE		
(Water	qt	2½)
(Cornstarch, edible	oz	5)
Sugar, refined, granulated	lb	1
(Salt, table	oz	½)
Oranges, fresh	lb	2
(Orange rind, grated	tbsp	1)
Pineapple, canned, crushed	No. 10 can	½
(Nutmeg, ground	tsp	1)
(Cloves, ground	tsp	3/4)
PAPRIKA BUTTERED POTATOES		
Potatoes, white, fresh	lb	45
(Water, boiling	gal	2½)
(Salt, table	lb	½)
Butter	lb	1
(Water, hot	cup	2)
(Paprika, ground		)
BUTTERED GREEN BEANS		
Beans, green, frozen	lb	12
(Water, boiling	qt	2½)
(Salt, table	oz	3)
(Sugar, refined, granulated	oz	2)
Butter	lb	2/3
(Pepper, black, ground		)
GREEN SALAD		
Lettuce, fresh	lb	9
Escarole, fresh	lb	2
Celery, fresh	lb	3
Endive, fresh	lb	2
VINAIGRETTE DRESSING		
(Mustard, ground	tsp	1½)
(Pepper, black, ground	tsp	1½)
(Pepper, cayenne, ground	tsp	½)
(Salt, table	oz	2½)
(Sugar, refined, granulated	oz	1)
(Water	oz	4)
(Onions, dry	oz	1-3/4)
(Parsley, fresh	oz	1)
Peppers, sweet, fresh	lb	1/8
(Pickles, cucumber, sweet, whole	lb	1/8)
(Salad oil	qt	1½)
(Vinegar, cider or wine	1-qt btl	½)
BREAD, FRESH, WHITE	lb	12
BUTTER	lb	3
CHOCOLATE CREAM PIE		
Crust:		
Flour, wheat, hard	lb	4½
(Salt, table	tbsp	4)
Shortening compound	lb	3
(Water, variable	qt	1)
Filling:		
(Milk, nonfat, dry	lb	2½)
(Water	qt	11½)
Dessert powder, starch base, chocolate	32-oz pkg	3
Meringue:		
(Meringue powder	oz	6)
(Water, cold	qt	1)
Sugar, refined, granulated	lb	2
(TEA		)
Lemons, fresh	lb	½
COFFEE, ROASTED	lb	2
Sugar, refined, granulated	lb	1-3/4
Milk, evaporated	14½-oz can	1

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Figure 3

Thursday - 2 February 1967

BREAKFAST

Chilled Tomato Juice [69]
Hot Oatmeal (K-4)
Ala Carte Menu
Grilled Bacon (A-65)
Raisin Toast

DINNER

Pea Soup [71]
Crackers
Veal Fricassee (A-96)
or Braised Veal Steak [21]
Mashed Potatoes (Q-86)
Buttered Carrots (Q-28)
Pickle Relish Cole Slaw (M-62)
Bread
Butter
Strawberry Shortcake (J-2) [63]
Tea
Coffee (R-21)
Milk[1]

SUPPER

Baked Ham (A-74) [13]
Hawaiian Sauce (O-21)
Paprika Buttered Potatoes (Q-79)
Buttered Green Beans (Q-9)
Green Salad
Vinaigrette Dressing (M-99)
Bread
Butter
Chocolate Cream Pie [55]
Tea
Coffee (R-21)
Milk[1]

ISSUE CHART

INGREDIENTS - 100 MEN		UNIT	BREAKFAST	DINNER	SUPPER	TOTAL 1 DAY	COST
PERISHABLE							
MEAT AND MEAT PRODUCTS:	Bacon, slab, chilled	lb	14	--	--	14	
	Ham, smoked, chilled	lb	--	--	52	52	
	Ham, cooked, chilled, smoked, boneless[2]	lb	--	--	30	30	
	Veal, sides, chilled (A)	lb	--	45	--	45	
	Veal, boneless, frozen, flaked steak (AF)	lb	--	32	--	32	
DAIRY FOODS AND EGGS:	Butter	lb	3.13	5.50	4.67	13.30	
	Eggs, shell	doz	14	--	--	14	
	Milk	gal	6.25	--	--	6.25	
FRUITS, FRESH:	Lemons, fresh	lb	--	.25	.25	.50	
	Oranges, fresh	lb	--	--	2	2	
VEGETABLES, FRESH:	Cabbage, fresh	lb	--	12	--	12	
	Carrots, fresh	lb	--	15	--	15	
	Celery, fresh	lb	--	3	3	6	
	Endive, fresh	lb	--	--	2	2	
	Escarole, fresh	lb	--	--	2	2	
	Lettuce, fresh	lb	--	--	9	9	
	Onions, dry	lb	--	5	--	5	
	Peppers, sweet, fresh	lb	--	.67	.13	.80	
	Potatoes, white, fresh	lb	--	45	45	90	
FRUITS, FROZEN:	Strawberries, frozen	lb	--	20	--	20	
VEGETABLES, FROZEN:	Beans, green, frozen	lb	--	--	12	12	
MISCELLANEOUS:	Bread, fresh, raisin	lb	6	--	--	6	
	Bread, fresh, white	lb	6	12	12	30	
	Shortening compound	lb	.50	3.13	3	6.63	
NONPERISHABLE							
DAIRY FOODS AND EGGS:	Milk, evaporated	14½-oz can	1	1	1	3	
FRUITS AND VEGETABLES:	Juice, tomato, canned, 3 plus 1	36-oz can	4	--	--	4	
	Pimientos, canned	7-oz can	--	.67	--	.67	
	Pineapple, canned, crushed	No.10 can	--	--	.50	.50	
BAKERY AND CEREAL PRODUCTS:	Cereal, prepared	pkg	25	--	--	25	
	Cereal, rolled oats	20-oz pkg	2	--	--	2	
	Flour, wheat, hard	lb	--	8	4.50	12.50	
SUGAR, CONFECTIONERY AND NUTS:	Sugar, brown	1-lb pkg	--	--	3	3	
	Sugar, refined, granulated	lb	6	3.25	4.75	14	
SOUPS AND BOUILLONS:	Soup, dehydrated, green pea	No.3 cyl can	--	2	--	2	
SPECIAL DIETARY FOODS AND FOOD SPECIALTY PREPARATIONS:	Dessert powder, starch base, chocolate	32-oz pkg	--	--	3	3	
	Topping, dessert and bakery products, dehydrated	1-lb can	--	2	--	2	
COFFEE, TEA AND COCOA:	Coffee, roasted	lb	3	2	2	7	

See page 70 for menu notes.

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Figure 4

[illegible] RECAPITULATION OF MASTER MENU ISSUES

ITEM	UNIT	M/C	25	26	27	28	Sat 29	Sun 30	31	1	2	3	4	5	Sat 6	Sun 7	8	9	10
MEAT, POULTRY AND FISH																			
Meat and Meat Products																			
8905-551-9908 Bacon, slab, chilled	lb	B	14	14		14	14	14		14		14	14	14		14	14	14	
		D				1.75	1.75				1				6			3	.50
		S					2.50												
Beef, carcass, chilled (ARMY)	lb	B			35														
		D						60			35	60	35	45					
		S	60	45						45					60	45	35	60	35
OR																			
8905-027-6556 Beef, boneless, frozen 1/ (AIR FORCE)	lb																		
Grill steaks	lb	D						47											
Swiss steaks	lb	S													38				
Oven roasts	lb	D										39							
		S																39	
Pot roasts	lb	S	39																
Diced	lb	S								30						30			
Ground	lb	B			20														
		D									23		23	30					
		S		30													23		23
8905-965-4719 Beef, dried, chilled	lb	B																	
8905-285-2075 Beef, ground, frozen	lb	D																	
8905-127-8229 Beef liver, frozen (ARMY)	lb	D													25				
OR																			
8905-655-8410 Beef liver, frozen, sliced 1/ (AIR FORCE)	lb	D													25				

1/ For use at Army installations not serviced by a Central Meat Processing Facility.

2/ This item is also authorized for use at Army installations with Central Meat Processing Facilities if they so desire

USASC FORM REV 6 OCT 64 28-200

PREVIOUS EDITIONS ARE OBSOLETE

Figure 5

MENU ISSUES														FOR THE MONTH OF: MAY 1967							PAGE 1			
4	5	Sat 6	Sun 7	8	9	10	11	12	Sat 13	Sun 14	15	16	17	18	19	Sat 20	Sun 21	22	23	24	TOTAL MEAL	TOTAL GRAND	UNIT PRICE	TOTAL PRICE
14	14		14	14	14		14	14		14	14	14	14		14		14	14		14	308			
		6			3	.50		2.50	1		5	1							1		24.50			
												1.25				3					6.75	339.25		
																					35			
	45						45		35				45	60	35				35		490			
		60	45	35	60	35		60		45	60	35				45		60		45	735	1260(A)		
																						857(AF)	1/	
														47							94	94		
		38						38													76	76		
													39								78			
					39													39			78	156		
											39									39	117	117		
			30							30											90	90		
																					20			
	30						30		23						23.				23		175			
				23		23						23				30					129	324		
														7							7	7		
															7				7		14	14		
		25																25			50	50(A)		
		25																25			50	50(AF)	1/	
...ilities if they so desire																								

PREVIOUS EDITIONS ARE OBSOLETE

Figure 5

B

clerks doing this job, the chances of errors are great. Consequently, every posting must be checked carefully to assure accuracy. At the present time, the analyses relative to nutritional adequacy and costing of the menu must rely heavily on much statistical data which is accumulated manually. You can readily understand, with this amount of clerical work, why we were anxious to convert our program to ADP.

The development and implementation of an Automatic Data Processing system, I have learned, is a complex and detailed process. We have relied upon the assistance of the programming specialists of the Data Processing Unit servicing our office. They determined that the equipment in their organization was capable of performing the required operations and have outlined the procedures by which this work will be accomplished. At first we were using an IBM 407 printer and an IBM 609 calculator but have now converted to using a Univac 1005 Card Processor.

In the initial phases of automating the two documents, the Master Menu and Recapitulation, we had to resolve a number of problems:

1. First, each item in the Food Plan had to be assigned a number.

2. Then came the task of fitting nomenclature into a limited number of spaces. A field of 26 character spaces was established in the EAM cards to take care of nomenclature. For this purpose we had to develop a standard list of abbreviations.

3. Next came the submission of all our recipes to the data processing unit for conversion into the required card format. This in itself was a major project. Each recipe has to be assigned a number designation. Whenever possible, numbers designating recipes in our recipe book were used. However, those menu items which are not included had to be assigned a local number. Items such as bread, butter, breakfast juices, relishes, etc. fall into this group. These local numbers will not appear in the final print-out.

After this multitude of information is punched into EAM card formats, the following steps are followed:

1. Submission of the menus to the Data Processing Unit by the dietitian using a special form. A sample copy of this form is depicted in Figure 6.

2. The Data Processing Unit will return a draft of the menu with caloric value by meal and daily totals as shown in Figure 7. The draft is reviewed and adjusted by the Joint Army-Air Force Master Menu Board and approved.

3. The Data Processing Unit then prepares a listing of the cost of the Menu (see Figure 8). The menu planner reviews this and again makes any adjustments necessary to increase or decrease the cost.

4. The Data Processing Unit wil then proceed to prepare the Master Menu manuscripts (see Figure 9). The first copies of each of the print-outs will be "camera ready," which means that they can be used to produce the printing plates needed.

In summary, we have established a procedure whereby all the clerical and statistical work will be performed by automatic data processing. The dietitian will merely send to the machine room a list of recipe numbers for each meal, and the document returned will be "camera ready" for printing and the total cost and total nutritional value computation will also be furnished.

This process is still in the trial phase. As soon as we are assured that it is a successful operation, we plan to investigate the use of the computer for additional phases of our program.

MASTER MENU RECIPE CODE SHEET						
298 Julian Date			Day Tuesday Date 25 October 1966			
Line Seq.	BREAKFAST (1)		DINNER (2)		SUPPER (3)	
	RECIPE NO.	Menu Note	RECIPE NO.	Menu Note	RECIPE NO.	Menu Note
01	6-43	55	R-77		A-73/2	15
02	2-30		5-34		K-7/3	
03	A-65/2		A-14/2	2	5-55	
04	J-16/1		G-79/3		G-40/3	
05			G-14/2		4-5	
06			H-67		H-89	
07			4-64		5-4	
08			5-4		5-56	
09			5-56		6-68	46
10			6-1		7-4	
11			7-4		R-21/2	
12			R-21/2		7-2	1
13			7-2	1		
14						
15						
16						
17						

Figure 6

WEDNESDAY 25 JANUARY 1967

BREAKFAST	RECIPE	SEQ	CAL
FRESH GRAPEFRUIT	6024	1	36
HOT OATMEAL	K004	2	92
ALA CARTE MENU	2020	3	745
GRILLED BACON	A0652	4	124
			997*

DINNER			
BEAN SOUP	R0391	1	106
CRACKERS	5024	2	30
STEAMED FRANKFURTERS	A052	3	338
CATSUP	1040	4	
MUSTARD	1042	5	
MACARONI AND CHEESE	2011	6	277
STEWED TOMATOES	G1081	7	42
ASSORTED RELISH TRAY	4145	8	6
FRANKFURTER ROLLS	J0323	9	336
CHILLED PEARS	6030	10	91
PEANUT BUTTER COOKIES	6007	11	123
TEA	7004	12	
COFFEE	R0212	13	36
MILK	7002	14	
			1,385*

SUPPER			
BAKED PORK CHOPS	A066	1	425
BROWN GRAVY	C001	2	19
LYONNAISE POTATOES	G085	3	208
SIMMERED SAUERKRAUT	G095	4	20
BANANA GELATIN SALAD	H0026	5	92
SALAD DRESSING	4009	6	40
BREAD	5004	7	147
BUTTER	5056	8	97
BUTTERSCOTCH BROWNIES	6013	9	287
TEA	7004	10	
COFFEE	R0212	11	36
MILK	7002	12	
			1,371*
			3,753**

Figure 7

THURSDAY 25 MAY 1967

BREAKFAST	DINNER	SUPPER
CHILLED APPLE JUICE	GRILLED FRANKFURTERS (A-48) 11	BEEF BOUILLON WITH RICE (R-40)
STEWED PRUNES	CATSUP	CRACKERS
ALA CARTE MENU	MUSTARD	SWISS STEAK (A-14) 2
PAN BROILED BACON (A-65)	COTTAGE FRIED POTATOES (Q-77)	MASHED POTATOES (Q-86)
	SLICED TOMATOES	BUTTERED SUCCOTASH (Q-103)
	MACARONI CLUB SALAD (H-54)	ASSORTED CRISP RELISHES
	FRANKFURTER ROLLS (J-32)	BREAD
	BANANA CAKE 40	BUTTER
	BANANA BUTTER CREAM	CHILLED PINEAPPLE
	FROSTING 50	OATMEAL COOKIES (D-48)
	LEMONADE (R-28)	TEA
	MILK 1	COFFEE (R-21)
		MILK 1

ISSUE CHART

INGREDIENTS-100 MEN	UNIT	BREAKFAST	DINNER	SUPPER	TOT 1 DAY	COST
PERISHABLE						
BACON SLAB CHILLED	LB	14	--	--	14	
BEEF BNLS FRZ SWISS STEAK	LB	--	--	38	38	
BEEF CARCASS CHILLED	LB	--	--	60	60	
FRANKFURTERS CHILLED	LB	--	25	--	25	
FRANKFURTERS FROZEN	LB	--	25	--	25	
BUTTER	LB	3	2.25	4.67	9.92	
EGGS SHELL	DZ	14	3.83	.50	18.33	
MILK	GL	6.25	--	--	6.25	
BANANAS FRESH	LB	--	7	--	7	
BEANS LIMA FROZEN	LB	--	--	5	5	
CARROTS FRESH	LB	--	--	1.25	1.25	
CELERY FRESH	LB	--	5.25	2.75	8	
CORN FROZEN WHOLE GRAIN	LB	--	--	7	7	
CUCUMBERS FRESH	LB	--	--	4	4	
JUICE LEMON FRZ 32 FL OZ	CN	--	1	--	1	
LEMONS FRESH	LB	.25	.50	.25	1	
LETTUCE FRESH	LB	--	5	--	5	
ONIONS DRY	LB	--	1.25	1.25	2.50	
PARSLEY FRESH	LB	--	.38	--	.38	
PEPPERS SWEET FRESH	LB	--	1.25	1.50	2.75	
POTATOES WHITE FRESH	LB	--	45	45	90	
RADISHES FRESH	LB	--	--	3	3	
TOMATOES FRESH	LB	--	30	--	30	
BREAD FRESH WHITE	LB	12	--	12	24	
SHORTENING COMPOUND	LB	.50	4.80	2.25	7.55	
NONPERISHABLE						
MILK EVAPORATED 14-1/2 OZ	CN	1	--	1	2	
JUICE APPLE CANNED #3 CYL	CN	6	--	--	6	
PIMIENTOS CANNED 7 OZ	CN	--	3	--	3	
PINEAPPLE CND SLICES #10	CN	--	--	3	3	
PRUNES DRIED	LB	3.50	--	--	3.50	
RAISINS 15-1/2 OZ	CT	--	--	1.50	1.50	
CEREAL PREPARED	CT	50	--	--	50	
CEREAL ROLLED OATS 20 OZ	CT	--	--	1	1	
FLOUR WHEAT HARD	LB	--	12	5.63	17.63	
FLOUR WHEAT SOFT	LB	--	3.25	--	3.25	
MACARONI	LB	--	4	--	4	
RICE PARBOILED	LB	--	--	1.50	1.50	
SUGAR REFINED GRANULATED	LB	4.75	11.75	4	20.50	
SUGAR REFINED PWDRD 1 LB	CT	--	4.75	--	4.75	
COFFEE ROASTED	LB	3	--	2	5	

SEE PAGE 70 FOR MENU NOTES.

Figure 8

THURSDAY 25 MAY 1967

BREAKFAST	UI	QNTY
CHILLED APPLE JUICE		
JUICE APPLE CANNED #3 CYL	CN	6
STEWED PRUNES		
PRUNES DRIED	LB	3-1/2
SUGAR REFINED GRANULATED	LB	1/4
LEMONS FRESH	LB	1/4
PAN BROILED BACON		
BACON SLAB CHILLED	LB	14

DINNER	UI	QNTY
GRILLED FRANKFURTERS		
FRANKFURTERS CHILLED	LB	25
- OR		
FRANKFURTERS FROZEN	LB	25
CATSUP		
(CATSUP TOMATO		)
MUSTARD		
(MUSTARD PREPARED		)
COTTAGE FRIED POTATOES		
POTATOES WHITE FRESH	LB	45
SHORTENING COMPOUND	LB	1-1/2
(SALT TABLE	OZ	3)
(PEPPER BLACK GROUND	TS	1-1/2)
SLICED TOMATOES		
TOMATOES FRESH	LB	30
MACARONI CLUB SALAD		
MACARONI	LB	4
(SALT TABLE	CP	1/2)
(WATER BOILING	GL	4)
EGGS SHELL	DZ	2
CELERY FRESH	LB	5-1/4
ONIONS DRY	LB	1-1/4
PARSLEY FRESH	LB	3/8
PEPPERS SWEET FRESH	LB	1-1/4
PIMIENTOS CANNED 7 OZ	CN	3
(PKLS CUC SWT WHL	QT	1-1/4)
(SALAD DRESSING	QT	1)
(MILK NONFAT DRY	OZ	6-1/2)
(WATER	CP	3-1/2)
(MUSTARD GROUND	TB	1)
(PEPPER BLACK GROUND	TS	1)
(SALT TABLE	TB	3)
(VINEGAR CIDER/WINE	CP	1)
LETTUCE FRESH	LB	5
(PAPRIKA GROUND	TB	2)
FRANKFURTER ROLLS		
(YEAST BAKERS ACTIVE DRY	OZ	3-1/2)
(WATER FOR YEAST	TB	7)
(MILK NONFAT DRY	LB	1/2)
(WATER COLD	QT	3-1/2)
SUGAR REFINED GRANULATED	LB	1-1/2
(SALT TABLE	TB	5-1/4)
SHORTENING COMPOUND	LB	1-2/3
FLOUR WHEAT HARD	LB	12
BUTTER WASH		
BUTTER	LB	1
BANANA CAKE		
FLOUR WHEAT SOFT	LB	3-1/4
SUGAR REFINED GRANULATED	LB	3-1/4
(SALT TABLE	TB	2)
(BAKING POWDER	TB	3-1/2)
(BAKING SODA	TB	2-3/4)
(MILK NONFAT DRY	OZ	3)
BANANAS FRESH	LB	5
SHORTENING COMPOUND	LB	1-5/8
(WATER	CP	2-3/4)
EGGS SHELL	DZ	1-5/6
(FLAVORING IMIT VANILLA	TB	3)
BANANA BTR CRM FROSTING		
BUTTER	LB	1-1/4
SUGAR REFINED PWDRD 1 LB	CT	4-3/4
(SALT TABLE	TS	1)
BANANAS FRESH	LB	2
LEMONS FRESH	LB	1/2
LEMONADE		
SUGAR REFINED GRANULATED	LB	7
(WATER HOT	GL	1-1/2)
JUICE LEMON FRZ 32 FL OZ	CN	1
(WATER COLD	GL	4-1/2)
(ICE CRACKED	LB	12)

SUPPER	UI	QNTY
BEEF BOUILLON WITH RICE		
(BEEF BONES CRACKED	LB	30)
(WATER COLD	GL	7)
CARROTS FRESH	LB	1-1/4
CELERY FRESH	LB	1-1/4
ONIONS DRY	LB	1-1/4
(BAY LEAVES WHOLE	EA	3)
(PEPPER BLACK GROUND	TS	1)
(SALT TABLE	OZ	5)
RICE PARBOILED	LB	1-1/2
CRACKERS		
(CRACKER SODA SALTED		)
SWISS STEAK		
BEEF CARCASS CHILLED	LB	60
OR		
BEEF BNLS FRZ SWISS STEAK	LB	38
FLOUR WHEAT HARD	LB	2-1/4
(SALT TABLE	LB	1/2)
(SHORTENING COMPOUND	LB	2)
(ONIONS DEHY SLICED	OZ	2-1/4)
(WATER	GL	2)
GRAVY		
FLOUR WHEAT HARD	LB	1-1/8
(WATER COLD	QT	2)
(SALT TABLE	OZ	2-1/2)
(PEPPER BLACK GROUND	TS	2)
MASHED POTATOES		
POTATOES WHITE FRESH	LB	45
(WATER BOILING	GL	2-1/2)
(SALT TABLE	CP	3/4)
(MILK NONFAT DRY	OZ	14-1/2)
(WATER	QT	4-1/4)
BUTTER	LB	1
(SALT TABLE	TB	3)
BUTTERED SUCCOTASH		
BEANS LIMA FROZEN	LB	5
CORN FROZEN WHOLE GRAIN	LB	7
(WATER BOILING	QT	1-2/3)
(SALT TABLE	OZ	2)
BUTTER	LB	2/3
(PEPPER BLACK GROUND	TS	1-1/3)
(PARSLEY FRESH	OZ	1-1/3)
ASSORTED CRISP RELISHES		
CELERY FRESH	LB	1-1/2
CUCUMBERS FRESH	LB	4
PEPPERS SWEET FRESH	LB	1-1/2
RADISHES FRESH	LB	3
BREAD		
BREAD FRESH WHITE	LB	12
BUTTER		
BUTTER	LB	3
CHILLED PINEAPPLE		
PINEAPPLE CND SLICES #10	CN	3
OATMEAL COOKIES		
FLOUR WHEAT HARD	LB	2-1/4
(BAKING POWDER	TB	2-3/4)
(SALT TABLE	TS	3-1/2)
(CINNAMON GROUND	TB	1-1/2)
(NUTMEG GROUND	TB	1/2)
(CLOVES GROUND	TB	1/2)
SHORTENING COMPOUND	LB	2-1/4
SUGAR REFINED GRANULATED	LB	2-1/4
EGGS SHELL	DZ	1/2
CEREAL ROLLED OATS 20 OZ	CT	1
RAISINS 15-1/2 OZ	CT	1-1/2
(MILK NONFAT DRY	OZ	2-3/4)
(WATER	QT	3/4)
TEA		
(TEA		)
LEMONS FRESH	LB	1/4
COFFEE		
COFFEE ROASTED	LB	2
SUGAR REFINED GRANULATED	LB	1-3/4
MILK EVAPORATED 14-1/2 OZ	CN	1

Figure 9

THE ARMY HOSPITAL FOOD SERVICE DATA PROCESSING SYSTEM

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Walter Reed General Hospital
Washington, D.C.

The Food Service Division of Walter Reed General Hospital is headed by the Chief of Food Service, who is responsible to the Chief of Administrative Services for the hospital. The division has two branches--the Production and Service Branch and the Diet Therapy Branch. The Chief is the overall administrator of the division, carrying the responsibility for the food service operation in accordance with AR40-2 and local hospital policies. The Production and Service Branch is responsible for writing the menu for the dining room and regular diet patients, as well as for food procurement, food preparation, and food service. This latter area includes both dining room service for both ambulatory patients and authorized duty personnel, as well as service to bed patients in the wards. The Diet Therapy Branch is responsible for writing modified diets, handling diet orders, maintaining liaison with physicians and nursing service personnel, and maintaining contact with the patients to assure that they are consuming an optimally nutritious diet. This branch provides the information necessary for patient feeding. Diets are written and adjusted in accordance with TM 8-500, the Hospital Diet Manual.

The hospital food service system has some similarities to the troop feeding system. The value of the hospital ration is the value of the troop ration plus the cost of three half pints of milk, and therefore, the hospital ration fluctuates as the troop ration fluctuates. The hospital depends upon the commissary for all food procurement. However, the hospital writes its own menu, which is <u>not</u> centrally controlled as is the case with the troop messes.

The Production and Service Branch is the most amenable to data processing applications. The work of the Diet Therapy Branch is done on an individual patient basis and, therefore, is not easily reduced to numerical information. The Production and Service Branch performs a service (and is often considered a service organization), resulting from a demanding and exacting production schedule which must be planned and maintained. Much of the information necessary to insure high quality production is numerical, and therefore, lends itself to computer handling. For example, we must project or try to estimate the number of people that we are going to feed, and what specific deadlines are to be met. Our menu is made up of recipes which have specific ingredient amounts and, when offering a choice of two or more items, we must estimate and use a percentage for each. Similarly, specific quantities of food must be ordered and received at specific times so that the menu items can be prepared.

I would like to first outline our proposed data processing system in its entirety and then come back to emphasize those things which are food related. We have essentially divided the project into three phases. The first phase (see Figure 1), is concerned with Recipe Expansion, based on recipes geared for 100 servings. The output of the Recipe Expansion phase will provide the information necessary for production section food ordering from our Food Supply Section. From this point we will move into the development of a Perpetual Inventory System, to include food procurement orders from the commissary. The Inventory System will provide all food cost procedures for records and reports required by AR 40-2. The second phase consists of labor costing, work scheduling, requirements by employee skill level, nutritional analysis of regular and modified diets, and an equipment information system including both property book equipment and expendable supplies control. The third phase would consist of selective menu planning and the writing of modified diets for individual patients on a daily basis from the modified diet menus. These would take into consideration the patient's food tolerances.

I think a word of explanation is required here concerning why menu planning is at the bottom of our list as far as computer application is concerned. Certainly computerized menu planning is possible and quite worth while in terms of the ultimate menu cost savings. We did feel that, in an operating situation, a large quantity of paper work could be eliminated and considerable cost reduction effected in the time that it would take to develop a computerized menu planning system. Therefore, it was decided to begin the system with a hand-written menu. A second reason for delaying the menu planning portion of the system was that the hospital normally uses a menu cycle varying in length from three to six weeks, so that menu planning is done at the most two or three times a year. Therefore, comparatively little of the dieticians' time is being spent in menu planning.

We are considering the basis of the data processing system to be the Recipe File (see Figure 2), though as far as the Recipe File and the menu are concerned, it could be a matter of debate as to "which comes first." The Recipe File now contains (or will eventually contain), much descriptive information about the recipe in question. The recipe number identifies not only the recipe itself, but correlates the recipe with the Food Code Worksheet (DA Forms 2932, 2932-1, 2932-2) which are forms used to designate modified diet food types. The number is composed of four parts, the first of these is a letter

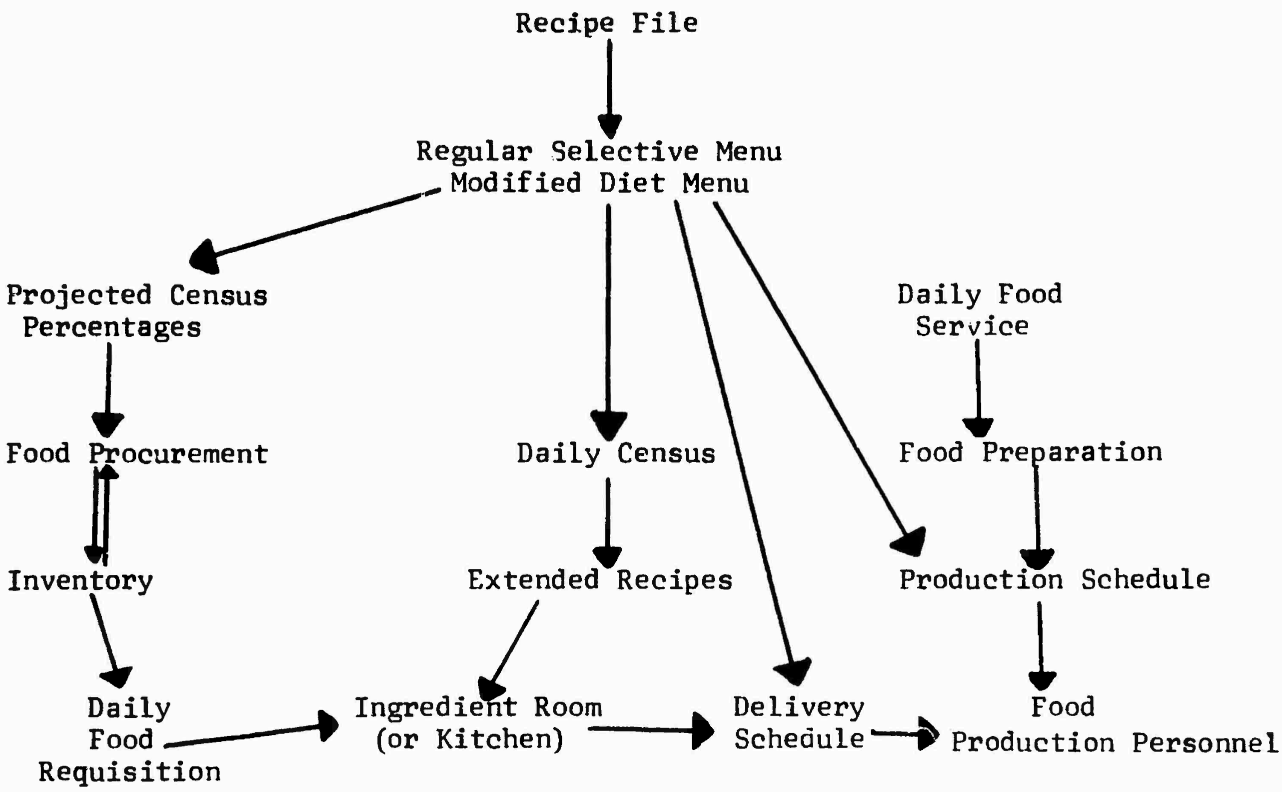


Figure 1 - HOSPITAL FOOD SERVICE INFORMATION SYSTEM

Provides:	For:
1. Recipe number	Correct recipe use
2. Ingredients (by #)	Requisitioning and preparation
3. Amount/100 servings	
4. Prep. instructions	Cooking procedures
5. Total preparation time	Delivery and personnel scheduling
6. Equipment needed (utensils, pans, cooking equip.)	Equipment scheduling
7. Batch size	Equipment scheduling (quality control)
8. Portion size	Portion control

Figure 2 - RECIPE FILE

indicating the general food category of the recipe, for example, S for soup, M for meat, V for vegetable, and so on. The second part of the number is a sequence number within the section and is used simply for identification purposes. The third part of the number is the numerical correlation with the code line number on the Food Code Worksheet and indicates the first code line on which the recipe can be used. The fourth part of the number is a recipe variation number.

The Recipe File also contains the ingredients, the amount of each ingredient per 100 servings, and the unit size. It is also our plan to include the recipe instructions with the output of the Extended Recipe so that a card or book recipe file can be eliminated. The File will also contain information on preparation time so that eventually we can schedule the recipe ingredients into the kitchen automatically. It will contain information on the requirements for equipment necessary to prepare the item, including cooking equipment, cooking pans, serving pans, and serving utensils. The Recipe File also contains information on minimum and maximum batch sizes, so that ingredient amounts will be calculated to correlate with the amount of food that a given piece of equipment can handle. It will contain information on portion size to assist in the problem of portion control.

The Inventory System (see Figure 3), is the step which follows the Recipe Expansion. From the menu, the projected census figures, the percentage estimates on choice items, stock level information, and the current inventory status, we hope to be able to prepare virtually all of the food procurement orders from the commissary. From the daily food requisition, prepared as a consolidation of the Recipe Expansion and the Meat Processing Record, we will determine daily food requirements and costs. Food purchases will also be costed. The system will be handled on an exception basis, so that human input to the system will only be necessary if food receipts or issues do not occur as scheduled. For instance, when the order is prepared, the information on quantity ordered will be stored. Only if the quantity requested and the quantity received are <u>not</u> identical would any entry into the system be necessary.

Information:	Provides:
Menu	
Projected census Choice percentages Stock levels Current inventory status	Food procurement orders with estimated cost
Daily food requisition Meat processing record	Food issues with cost
Food actually received	Food purchase cost

Figure 3 - PERPETUAL INVENTORY SYSTEM

LINEAR PROGRAMMING FOR DIETETICS

(Synopsis Only, Transcript Not Available)

Miss Helen M. Brisbane
Dept. of Data Management
Veterans Administration
Washington, D.C.

The Veterans Administration currently has some 125,000 hospital patients including TB cases and psychiatric cases, of which approximately 50% are on some form of modified diet. About 10% of these patients do not require actual hospitalization and are housed in various rest homes.

The V.A. market is centered in Illinois in which most of the supply procurement takes place through centralized offices. For staple items, all V.A. installations pay the same price. The V.A. has a frozen food plan for vegetables, fish, fruits and eggs, and 75% of the V.A. hospitals are in this plan. In addition to frozen foods, 53 installations use a prefabricated beef whose price is determined by warehouses rather than butchers. Twelve hospitals get frozen meats and fresh eggs from the Defense Supply Agency (DSA). All V.A. installations use a common food plan although prices vary with each location.

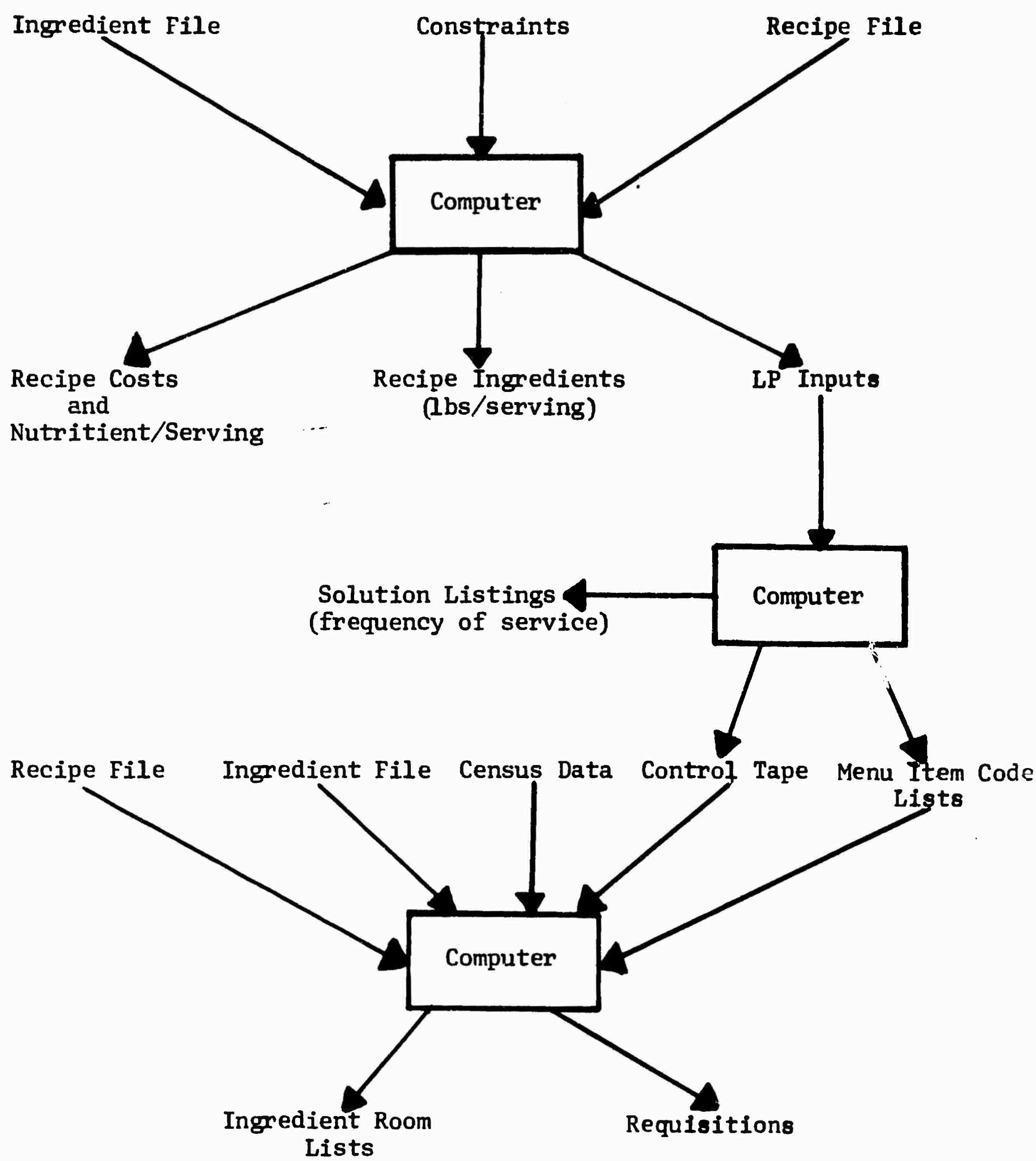
Menus for each installation are planned by dietitians at the installation in question. Cycle menus are used, but the cycle time depends upon the installation; four to five weeks is most common. In 1946, the Uniform Ration Raw Food Pattern was established to make menus nutritionally adequate and to provide moderate cost meals. Using the pattern, the V.A. has the obligation to justify forms like all government agencies. The Ration Pattern currently has a goal of 5½ pounds of food per patient per day. As early as 1955, it became apparent that the menus arising from this Pattern could be regulated by machine.

In 1961, a contract was let to investigate the feasibility of using a computer and linear programming in the planning area. A study team approach was used in the investigation and each team included a dietitian. Recipe variables susceptible to constraint included nutrition allowances, preferences and frequencies. The primary object of the linear programming application was to provide a list of foods meeting the established constraints but which are unquoted as to time sequence. These foods are then manually combined into 28-day menu plans. The reason for the manual combination is that Miss Brisbane does not feel that anyone has come up with good means of encoding some of the considerations involved in menu planning. These include, but are not restricted to such things as color, roughage, and the garbage problems.

The linear program used by the V.A. is one designated M3 by Standard Oil of California, and is a program originally developed for gasoline-cracking optimization on the IBM 7094 computer. A newer version of the program will be incorporated for use on the IBM 360 Model 65.

Five feeding programs are optimized independently for a regular diet and each of four modified diets incorporating both selective and nonselective menus. The input requirements of the model include the ingredient file, a forecast of prices, and a list of recipes and their ingredients (see Figure 1). A set of constraints has been previously established taking into account such items as cost, nutritive content, preferences, etc. An interesting additional constraint was the inclusion of a frequency rating for each recipe, which specifies the minimum and maximum time periods between successive servings of a given recipe. This linear programming model is included in a larger computer system which provides additional information including summaries of recipe cost, nutrition per serving, recipe ingredients, pounds per serving, ingredient lists for acquisition, food supplies and requisitions for resupply.

It was Miss Brisbanes' opinion that an important aspect of the computerized food service was the savings in cataloging and inventory aspects of such a system.



Ingredient File
Constraints
Recipe File
Computer
Recipe Costs and Nutritient/Serving
Recipe Ingredients (lbs/serving)
LP Inputs
Solution Listings (frequency of service)
Computer
Recipe File
Ingredient File
Census Data
Control Tape
Menu Item Code Lists
Computer
Ingredient Room Lists
Requisitions

FIGURE 1

DEVELOPMENTS FOR HOTELS AND INSTITUTIONS

(Synopsis Only, Transcript Not Available)

Prof. Charles Sayles
Director of Research
School of Hotel Administration
Cornell University
Ithaca, N.Y.

Prof. Sayles' talk centered around the hotel management aspects of computerized food service function. He briefly described a real-time on-line system which would be appropriate for hotels. He felt that the difficulty was to find a single supervisor for all of the centralized equipment in such a system, such as is now used in hospitals by Medinet and Western Union.

Prof. Sayles next noted that sophisticated computer systems are not needed to provide automated food-planning functions and that unit record equipment such as the IBM 402 printer, the IBM 514 card reproducer and the IBM 206 card punch, all relatively inexpensive electronic accounting machines, would provide some of the answers that a hotel would be interested in. He briefly went on to describe the proper incentive in hotel operation as it applies to the food service function with the overall hotel operation. He noted that hotel management regards the differences between the amount of food prepared and the amount of food actually consumed with less importance than do government agencies.

Prof. Sayles concluded by stating some of the objectives he feels are important in any computerized food service function. These include provisions for variety and choice, statement of the quantity of food to be prepared, statement of the menu, menu file, cycle time, ingredients required, and some form of price card. His point of view centered around the possible application of EAM equipment to such functions.

SECTION II

TRANSCRIPTS OF WORKING SESSIONS

WORKING SESSION A

April 4, 1967

Tuesday Afternoon Session

Editor:

This session dealt with input requirements.

Professor Casbergue:

Professor Casbergue presented and described examples of computer printouts which he had described in his lecture given during the morning session. In answer to a question regarding what kind of data should be used in menu planning, he noted that his model takes into account the nutrient content of each menu item for each of seventeen nutrients. He felt that any computer system should be required to prepare a listing of the total food item issued against those served. In order to do this, all items would have to be listed, including such ordinary items as table salt. An additional area of standardization for recipe preparation would be manpower timing since any total systems approach to the problem must include the time required in the various stages of recipe preparation. Professor Casbergue also mentioned that Captain Sager's food handling room was a good idea.

Editor:

The session next shifted its attention to determining those outputs that would be desirable from any computerized system. It was generally agreed that the primary input to such a system would be the menu Bill of Fare. The outputs of the system would include:

a) Issue Amounts - by recipe and daily total.

b) Unit Level - storeroom issue authorization.

c) Recipe for Correct Amount, Ingredient Time, Procedure, Equipment, and Personnel.

d) Cost Data Summaries.

e) Nutrient Levels - by exception only

f) Cost Report Comparison - by exception only

g) Budget Review Capability.

A certain amount of disagreement ensued as to whether the procedure should be reprinted every time.

Captain Chaska:

Captain Chaska voiced support for reprinting and stated that it would be extremely useful.

Editor:

Considerable discussion ensued concerning the need for output procedures. Some answers were cited such as forcing people to review recipe preparation as well as providing the food preparation personnel with an up-to-date version of the existing procedural scheme. Disadvantages that were noted included the realistic consideration of reprinting the same recipe day after day, at least in the case of the more common recipes. The inquiry capability of one-line computer systems and possible use of microfilm were alternatives that were also considered. The session ended with a clarification of the point that the military operates on a total budget and a cost per ration basis. Minimum cost food plans and menu plans are not a consideration.

WORKING SESSION B

April 5, 1967

Wednesday Morning Session

Part I

Editor:

This session dealt with user needs and special requirements.

Mr. Henick:

Mr. Henick stated that any EDP system which will be applied to menu planning will not be implemented within one calendar year. Therefore, the conference should not restrict its discussions to such a system being established within two years. Our primary effort should consist of defining what we want to do with the system (i.e., do we even want to use it for menu planning, or are other functions more important) and what the user needs are.

Editor:

Mr. Henick introduced Doctor Paul Buck of the Natick Laboratories.

Doctor Buck:

Doctor Buck gave a dissertation on the time-shared computer concept - in essence, a large central computer serving a number of users through remote consoles. He suggested the possibility of linking several Army bases together so that a centralized menu planning facility could receive and disseminate information to several locations. He noted the economics of a single central processor and small remote terminals as compared to several local computers.

Professor Sayles:

Professor Sayles noted that in actuality, time-sharing is not being implemented with the speed promised by manufacturers. He cited the IBM 360/67, which has suffered a number of delivery delays and has been delivered at several locations, but is not functioning as yet.

Mr. Hopper:

Mr. Hopper pointed out that the IBM 360/67 is not the only time-shared computer and that other services, KEYDATA Corp., for example, are up and running.

Mr. Baust:

Mr. Baust noted that some of the most difficult areas of the KEYDATA operation to implement were those of telecommunications and that those areas were not yet trouble-free.

Doctor Buck:

Doctor Buck admitted that telecommunications were a problem and noted that in his system to date, only half a message gets through. He noted that the Army Intelligence Agency is currently using an extensive communication system, although priorities are such that food planning would be low on the priority list. However, from the user standpoint the low priority would not be noticed.

Mr. Baust:

Mr. Baust stated that large computers are more efficient than small ones, and therefore a large computer-oriented teleprocessing system would be desirable. He noted that although smaller computers have been in use for some time (e.g., MIT's Project MAC started in 1961) efficiency can be increased with larger machines. A large machine has greater capability for the user than a small one.

Mr. Baust also discussed the possibility of both vocal and visual (graphics) communication, and stated that a serious investigation of these techniques for any proposed system should be an obligation of any study group.

Editor:

Miss Brisbane was introduced to give a description of linear programming which would be supplementary to her talk of April 4, 1967.

Miss Brisbane:

Miss Brisbane inititated her discussion with the comment that she had some experience with time sharing and was not impressed.

Editor:

This opening remark was directed at the discussions of Mr. Baust and Doctor Buck which had just concluded.

Miss Brisbane:

Miss Brisbane used as an example of linear programming a simple matrix whose vertical columns consisted of foods, e.g., apples, peaches, pears, etc., and whose horizontal rows were constraints such as calories, cost, etc. The elements of the matrix therefore consisted of items such as calories per apple or dollars per pear and so forth. She then described how the computer uses such a matrix to make up menus and then test that menu to see that a selection does not exceed a certain number of calories or a cost which is given as a maximum. She explained that the program that the Veteran's Administration is now using can have its optimization done either to minimize cost or maximize preference. In other words, first a minimum cost is found for a constant preference; then, using this solution as a starting point, maximum preference with cost as a constraint is calculated.

Miss Brisbane pointed out that one of the most important byproducts of using linear programming is that the program gives the name of those variables which have constrained the solution as well the cost associated with the constraint. Therefore, the V.A. has been able to find out which assumptions they have made actually bind the solution; and therefore, they can re-evaluate whether those constraints are actually required.

Editor:

A brief question and answer session followed, an outline of which is given below.

Question:

What is the optimization function in linear programming?

Miss Brisbane:

Optimization for patient preferences with cost as a constraint (i.e., budget limitation).

Question:

Do you have any feeling for the percentage improvement which can be expected by using linear programming? Is 3-5% reasonable?

Miss Brisbane:

Miss Brisbane was hesitant to give out any figures but finally did state that the figure of 20%, which is in line with the studies at Tulane, would not be expected by the V.A. She expects that their figures will be much lower than 20%. Some of the greatest savings will come from interfacing the linear program with the V.A. inventory control.

Question:

For what period of time are menus planned?

Miss Brisbane:

Twenty-eight days repeated three times, and new menus are prepared quarterly.

Question:

When do you reprogram your machine for a new plan?

Miss Brisbane:

Every 3 months, 4 to 4½ months in advance of use. Miss Brisbane pointed out that the V.A. runs the program to cover a 28-day period which gives a food plan for those 28 days. The actual menu selection is done by hand from the 28-day food plan. She pointed out that the machine is run to make-up a plan 4 to 4½ months in advance.

Question:

What prices are you using?

Miss Brisbane:

The cost or prices used were in some cases the contract price and in others a predicted price. Miss Brisbane pointed out that the supply depot enters this pricing information automatically into the machine.

Question:

What is the average time that patients stay in the V.A. hospital?

Miss Brisbane:

Usually about 28 days, but this figure is deceiving since it is arrived at by patient turnover. In the tubercular hospital, the stay averages about nine months.

Mr. Hopper:

Mr. Hopper summarized linear programming, stating that it is a technique by which the program considers all possible menus, disregards all that don't meet certain requirements and selects the best of the feasible solutions. Using this technique one might expect to come up with at least a one or two percent improvement over a manual selection. Improvement results either from a dollar saving with no loss in desirability or an increase in desirability with no increase in cost.

It is admitted that there is a significant amount of work involved in setting up and running linear programs, and that this effort must be justified. However, this effort is more or less independent of the amount of money involved. Since the savings which are realized are a percentage of the total money involved, large spending will result in large savings. Therefore, the effort is constant while the savings are proportional to the expenditure.

The V.A. has approximately five percent of food cost of the Department of Defense, a relatively small amount, and yet it has found it economical to go ahead with a large linear program. Therefore, it would seem that the Department of Defense could easily justify a linear program for its larger users. In other words, one or two percent of a billion-plus dollars per year is a large amount of money.

In addition to optimization of food purchase, a management information system on the base level is also a concern. For example, a system of scheduling kitchen work, such as described by Captain Sager, may be more important in some cases than optimized food purchasing.

Editor:

Following Mr. Hopper's summarization of linear programming, the questioning of Miss Brisbane resumed.

Question:

At present the V.A. plans on a 28-day basis and decides all food which will be eaten in a 28-day period; however, the exact menu for each day is put together by dietitians. Why can't the computer perform this task?

Miss Brisbane:

The definition of constraints for the task is difficult, and as a result, it has not yet been put into operation. In answering this question, Miss Brisbane noted that using the computer output of a 28-day food plan, it has always been possible to create menus (i.e., the machine did not come up with unfeasible solutions).

Question:

If it could be done easily by the machine, would you be able to use it?

Miss Brisbane:

Yes! It would be implemented immediately. At the present level of experience this is not proving to be a problem, although in the future some changes will have to be made. Unfortunately, the optimal purchasing of food is not the only consideration for a computer system. Inventory control is equally important.

Editor:

This ended the question and answer period following Miss Brisbanes' discussion of linear programming. Miss Bollman was introduced next to discuss the Army Food Service needs for preparing the Master Food Plan.

Miss Bollman:

Miss Bollman discussed the preparation of the Master Food Plan, stating that it is prepared primarily from last year's Food Plan. The old plan is modified as a result of high preference rating for existing items, obtained by feedback from the field, as well as the desire to introduce new items and become the basis for the new plan. Given this base, about four man-days of dietitian time are required to come up with the new Master Food Plan. From this, a Frequency of Service plan is generated.

Miss Bollman stated that the most immediate need was for a machine that could print out a new menu resulting from changes due to local conditions rather than having a dietician make pencil changes to the standard menu.

Miss Brisbane:

Miss Brisbane noted that linear programming looks not only at the overall solution (i.e., optimized plan), but also at the constraints themselves. In this case, a change due to local conditions would be considered a constraint and the linear program would be able to give a modified Master Plan.

Editor:

The questions directed at Miss Bollman resumed.

Question:

Has a standard menu been decided on, and what are its advantages?

Miss Bollman:

Miss Bollman stated the advantages are two-fold: first, to allow large-scale testing of food, and second, to gear industry for large-scale food production. This latter advantage is the result of the long-range (i.e., one year) aspect of the plan. The former item is aimed at production testing and certain installations are selected as test subjects and feed-back test data to the Food Service. Testing may take place in the areas of packaging and quality, to cite two examples.

Editor:

A series of questions were asked regarding the different services. These are summarized as follows:

Lieutenant Sherwood:

The Navy's menu planning is completely de-centralized and is on a different ration from the other services.

Miss Niland:

The Marine Corps employs a master menu, but its use is not mandatory.

Editor:

There seems to be a difference of opinion as to the relative importance of food plans versus menu plans. One point raised was that menu planning is secondary and the discussion should center on food plans.

Army and Air Force:

These services use food plans which are generated eighteen months in advance. All changes (primarily for overseas) and modifications are manual. The long lead time is to allow for overseas supply logistics problems.

Miss Brisbane:

The V.A. uses a food plan which is made up for a 28-day period and which will be used three months later, thereby allowing a 4-4½ month lead time.

Mr. Kirkendoll:

The Defense Personnel Support Center does require a significant lead time, but the present one of eighteen months could probably be cut down. This lead time is used primarily for readjustments resulting from items which are in short supply. Supply problems requiring readjustments have to be fed back to the dietitians and the food plans modified accordingly.

A preliminary attempt at modification is performed at the Support Center in Philadelphia. This review is conducted with respect to procurement schedules which were established as a result of the previous food plan. Computers at the Supply Center are used both to modify food plans and to establish new procurement schedules.

If a problem is too large to be handled in-house at the Center, it is returned for modification to the agency originally generating the food plan.

Editor:

There followed a discussion by Miss Niland with respect to the procedures followed in the Marine Corps.

Miss Niland:

The Marine Corps does not have a master menu system. A recommended master menu is set-up by the Corps and sent out to each base. Each base usually sets up its own menu for the month using the master menu as a guide, while the recommended menu is used only by very small bases that don't want to set up their own. The Marine Corps can purchase some items locally, but most items are obtained from the Defense Personnel Supply Service. The Corps need only let the supply service know when it anticipates a demand for an item in excess of twenty percent over last year's procurement. Otherwise, the DPSS purchases on the basis that Marine Corps requests will be the same as last year. At present there is no overall optimization on price, only optimization within price. Consequently there exists little need for linear programming. Similarly, since the food plans change only slightly from year to year, alterations are minor.

Editor:

There followed a discussion by several individuals regarding transportation costs. In summary, this discussion brought out the facts that the cost of an item within the United States is invariant as to location. It was pointed out that there is a six percent surcharge on all items of food which cover the transportation costs.

WORKING SESSION C

April 5, 1967

Wednesday Morning Session

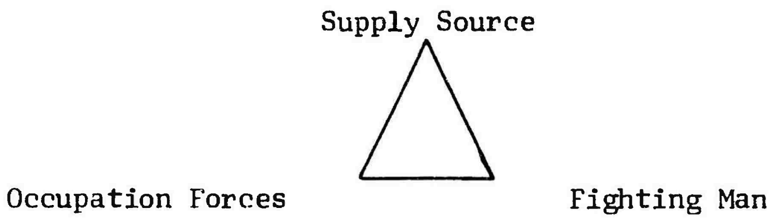
Part II

Editor:

This session dealt with Data Availability and Reliability.

Doctor Buck:

Doctor Buck proposed a concept for employing the computer for overseas modification of food plans to aid the fighting man. He recommended a system that would be implemented in Southeast Asia such that when the soldier wants fresh peaches, the request would be sent back through Japan to the United States and thence to the DPSS. He talked about the fact that if the requisition were processed through a computer system, it could be recorded and the recording would become the core of an inventory control system. He envisioned the system as a triangle as shown in the following figure. Doctor Buck felt that if such a generalized inventory and supply system were implemented for Southeast Asia, it could later be applied to the United States instead of the reverse.



Mr. Henick:

Mr. Henick noted that the "fighting man" represents only a small percentage of the feeding problem and 92% of the rations in Southeast Asia are Type A.

Professor Cournoyer:

Professor Cournoyer pointed out that equipment orders for any information systems are long range and any system which was ordered today would be two to three years in implementation prior to start of operation. Consequently, consideration of the "fighting man" can not be of prime importance. As a second comment, Professor Cournoyer stated that there is not now sufficient justification in terms of machine use to promote such a system. Machine-time accumulation is needed before any serious talk of large-scale computer systems can ensue.

Miss Bollman:

In contrast to Professor Cournoyer, Miss Bollman felt a primary need was to reduce the manpower needed to produce a menu. This time reduction would allow speedier modification for overseas menus.

Editor:

Mr. Henick summarized the discussions which had just concluded.

Mr. Henick:

Mr. Henick stated that whether or not there is a standard menu for all services is not the main consideration of the Conference, which was, after all, called to explore the use of computers in menu planning. Based on the previous discussions, Mr. Henick concluded that what is needed is a machine which is capable of responding rapidly to changes from the Master Menu or Master Food Plan due to local conditions, a task which is now done by pen and ink. He further stated that flexibility of response is more important than monetary considerations. Additional flexibility will allow new constraints which are not constrained by the Master Menu or Master Food Plan. In short, any system to be developed must be applicable to all potential users.

Mr. Henick:

Mr. Henick continued his summary by stating that the nature of any computer application would be to handle change rather than generation of original material (although this could be incorporated). In other words, there are now standard menus and standard food plans whose main problems result from changes caused by local and overseas conditions. These changes, rather than the origination of the master plans, cause the most dissipation of effort and greatest loss of efficiency. Therefore, the prime task of the computer would be to process these changes and modify the master plan in a minimum amount of time with a maximum of efficiency.

Editor:

Following Mr. Henick's summary, representatives of the different services concluded that a standard menu for all services, although not currently employed, was feasible for CONUS. A comparision of the magnitude of menu items showed a range from 300 items in the Army to about 700 for the Marine Corps. In addition to the menu items, there are lists of specialties. A basic menu of about 700 items for all services would seem reasonable although coordination between services would remain a problem. These problems of coordination would center around variations in both items and menus. For example, the Navy is a large user of dehydrated items on-board their vessels, while the Army does not make much use of dehydrated foods. Similarly, since the Navy and Marines have more money, they can serve more items; under a standard menu they would have to reduce this number or the Army would have to increase its number. Despite these differences, it was concluded that a standard menu could be drawn within the present monetary framework and that there would be definate advantages to performing a number of the planning functions on a machine. Reasons for using the computer were given as speed, accuracy, and economy. Mr. Hopper differed sharply these views.

Mr. Hopper:

Mr. Hopper stated that whenever a computer is asked solely to do that which is currently being done by hand, the computer proves to be uneconomical. It is only when one looks at the potential of the computer to perform tasks that have never been done by hand that its operation can be truly justified. Therefore, by considering only how the computer could be of advantage to what is currently being done, one would soon find himself using a computer for a typewriter.

Professor Cournoyer:

Professor Cournoyer suggested that an attempt should be made to outline the monetary advantages of the computer and try to put dollar signs on them. Among these are the optimization of preference and a better price because of lead time.

Editor:

A discussion was initiated to consider any future uses for computers. Mr. Baust made several suggestions.

Mr. Baust:

Mr. Baust questioned whether optimization should be on the basis of calories, and if a dietitian's consideration could be used as an optimization function.

Professor Cournoyer:

Professor Cournoyer asked how computers would affect research. A computer could be a valuable tool in a medical research laboratory which breaks down master menus to ascertain nutrients. In this case the value of the machine would not necessarily be immediately tangible.

Mr. Baust:

In answer to Professor Cournoyer's question, Mr. Baust stated that a computer could also be used for research as well as menu planning. For example, at one base a menu could be changed and monitored by an information system, while at the same time medical factors could be gathered. Controlled experiments could then be run for medical purposes.

Miss Bollman:

Miss Bollman stated that the Army Food Service has a medical laboratory that runs such experiments on the computer.

Mr. Henick:

Mr. Henick pointed out that once a computer system was implemented, there would be no limit to the different jobs it could handle. He noted that the problems arising from an inter-service difference in dehydrated versus fresh rations would not be difficult for the machine to handle. Therefore, once a system is developed for taking care of changes it could also be used for the generation of original menus. This wide application area would be a substantial justification for the use of machines.

Mr. Henick added that with a machine of sufficient flexibility it would be possible to tailor a menu for each overseas installation. A tailored menu such as this would be of great assistance. Similarly, a menu could be designed which would go along with the Army Master Food Plan or which would be geared to any other planning group. This would allow agencies which are presently independent of the Army the option of either remaining independent or going along with the Army. Therefore, a flexible computer would eliminate the problem of one agency conforming to the standards of another, thereby resolving a potential problem area.

Mr. McCarthy:

Mr. McCarthy suggested that a certain amount of knowledge could be gained regarding the present use of computers for procurement by having the Adams Associates' people visit the Defense Personnel Support Center in Philadelphia

Editor:

The working session was adjourned for lunch.

WORKING SESSION D

April 5, 1967

Wednesday Afternoon Session

Editor:

This session dealt with communications and compatibility. Mr. McCarthy was introduced to discuss the procurement aspects of menu planning from the standpoint of the Defense Personnel Support Center.

Mr. McCarthy:

Mr. McCarthy explained that procurement begins with a Master Food Plan which is submitted to the Center by the local agency dietitians. He noted that military procurement is only two percent of the total food market and therefore does not have much effect on food prices except when items must be procured after harvest. The Department of Defense will not procure before harvest because producers who bid on the procurement would have to pay higher wages for harvesters and therefore prefer to wait until after harvest to take military bids. By that time the military procurement might be ten percent of what's left and can have an effect on the market. Mr. McCarthy added that the cost for procurement includes six percent for transportation cost (which is invariant with location).

Following procurement, the Master Menu is sent out to Armed Forces installations with a memorandum stating that the menu should be followed. In general, the menu is followed, although the Navy and Marine Corps have the option of following their own menus at each installation. These services have far more flexibility than the other services Mr. McCarthy noted that recently an interservice committee had convened to determine if a standard menu is feasible for all services and although they decided it is, it has not yet been implemented. Implementation is scheduled for July 1, 1967. He added that this single Master Menu should be the basis for the conference's consideration.

Continuing, Mr. McCarthy stated that the single menu recommendations of the inter-service committee have been turned over to the armed services for their comments.

Mr. McCarthy stated that on the basis of menu planning alone, he didn't think that a computer program could be justified. However, he did describe a system (now used at one base) where each person gets a card when he comes into the mess hall and it is punched with what he eats. The card is then used for billing the person if he is required to pay. The information from these punched cards is used for inventory.

Editor:

Professor Cournoyer spoke next, and discussed some of the work done at the University of Massachusetts in predicting food requirements.

Professor Cournoyer:

Professor Cournoyer reported that recently the University of Massachusetts attempted to predict the number of people that would show up for any meal on any day. There are seventeen variables and they have found six significant correlations. By using these correlations they have been far more successful at predicting than the kitchen staff used to be and have cut down on waste considerably.

Editor:

Mr. McCarthy replied to Professor Cournoyer:

Mr. McCarthy:

Mr. McCarthy stated that the techniques employed by the University of Massachusetts might work well for a University but for a military base where people are largely transitory, the problem is enormously increased.

Editor:

Mr. Henick discussed some of the problems involved in implementing the standard menu for all of the Armed Services.

Mr. Henick:

Mr. Henick opened this discussion by reiterating the feasibility of a single menu for all of the Armed Services. He noted that:

a) By some method the menu would have to be based on the availability of foods.

b) The different services would have to formulate the menu together.

c) Changes in the menu to suit individual bases would have to be considered.

Mr. Henick noted that those people now producing menu and food plans for the individual services would have the responsibility of planning the combined service menu. They would, presumably, serve together on a Joint Menu Board. This same group would also be responsible for modifications to the menu and to their planning technique. It is possible that a computer would probably reduce the error factor.

Mr. Henick noted that the principle savings with this plan would be on the local mess level. He also noted that a single standard of training would have to be used for cooks of all services. At present, the Navy and Marines have an excellent system of training while the Army and Air Force are somewhat behind.

Editor:

A discussion was initiated regarding preference surveys.

Professor Cournoyer:

Professor Cournoyer noted that experience at the University of Massachusetts has shown that there is a significant discrepancy in a survey between what people say they like and what is actually thrown away in the garbage. He suggested that waste might be a better indication of what people do (or don't) like.

Editor:

Several individuals from the Army noted that their experience had been just the opposite of that of the University of Massachusetts. They had found a good correlation between surveys and actual tests.

Mr. Baust re-initiated the discussion of the punch-card charge system described by Mr. McCarthy earlier.

Mr. Baust:

Mr. Baust asked Mr. McCarthy what information actually came off the punch-card used to determine the charges in the mess hall described previously. Could this card be used to build a history?

Mr. McCarthy:

Mr. McCarthy explained that the card is used in two ways: first, to determine the actual personnel expenditures, and second, as input to the base's inventory system.

Mr. McCarthy also noted that the DPSC only buys what the Armed Services tell it to buy.

Editor:

Mr. Baust next made several observations based on the summaries of the discussions which had taken place during the session.

Mr. Baust:

Mr. Baust stated that any computer system which may evolve in the area of menu planning must be based on handling the requirements of all four services. He noted that there are still some variables which are ill-defined (food color, etc.)

and that further definition must take place. He raised the question of an interface with DPSC and asked whether this should be an integration with the DPSC system or merely an interface.

Mr. McCarthy:

Mr. McCarthy suggested to Mr. Baust that the interface be used for information transfer, not system integration.

Mr. Baust:

Mr. Baust then suggested the possibility of implementing a system similar to the V.A.'s which would give an annual food plan and a frequency plan. He suggested that the same operating model be used as that of the V.A. and queried that if optimization were on preference rather than on cost, under what advance time frame could a food plan be prepared.

Editor:

In answer to Mr. Baust's question, representatives from the Army said that it had to be a little more than a year in advance because of changes from overseas.

Mr. McCarthy said the DPSC had to have a year on some items, therefore a year was a good plan for them. As an example, he cited that DPSC is currently purchasing items for September/October delivery at a central depot and then an additional time must be allowed for local base delivery. One advantage of the computer would be to have the flexibility to give long lead time for items for bases which require it, but not to predicate the total system on the maximum.

Mr. Baust:

Continuing his discussion of potential system implementation, Mr. Baust attempted to outline the variables in the system as follows:

1. Recipes Used

2. Cost Factors (ingredients)

3. Ingredients

4. Nutrient Values (14 current, 20 maximum)

5. Type of Food (meal and course in conjunction with recipe)

6. Preference Data

7. Rules and Regulations

8. Food Availability (current and forecasted)

9. Capability of Handling Food (on site facilities)

10. Census Information (possibility of taking variations into account in centralized planning)

11. Local Autonomy (substitution)

It was noted that the Army Supply has the census figures for the armed forces and provides the census forecast to DPSC. These numbers would be supplied by them, not by the dietitian.

Mr. Hopper:

Mr. Hopper asked what happens to extras and leftovers.

Mr. McCarthy:

Mr. McCarthy answered that extras are taken into consideration by the DPSC inventory system.

Editor:

Mr. Hopper next discussed the requirements for a base-level information system.

Mr. Hopper:

Mr. Hopper stated that the capabilities of a small base information system might include ascertaining the nutrient requirements and costs job a particular day's menu. Such a system would allow job changes in the menu due to local conditions. It could also help with automatic inventory systems, collect usage factors (for selective menus) and feed-back change data into the information system automatically rather then having to make special studies. In addition, the system could be used for scheduling kitchen operations. Mr. Hopper then asked what kind of information systems military bases have at present, and how a potential menu planning system could interface with it.

Editor:

The answers to Mr. Hopper's questions were somewhat vague as to systems now employed by individual bases. The only positive remark was that most bases have their own costing systems. It was suggested that any centralized menu planning system should be able to produce information suitable for use by individual base cost systems. Reference was made to the Marine Corps base level menu option system as well as to the information system for kitchen use outlined by Captain Sager.

Mr. Henick closed the session with a request that participants submit written comments before leaving.

The Conference was adjourned.

SECTION III

AGENDA AND ATTENDANCE LIST

AGENDA

Conference on Computer Procedures for Menu Planning and Recipe Service for DoD Elements

Food Division, U.S. Army Natick Laboratories and the General Committee on Foods, Advisory Board on Military Personnel Supplies, National Research Council

4-5 April 1967

0730 Bus Leaves Motor Entrance, Statler Hilton Hotel, Boston. Room D-133

0900 Introduction and Purpose of Symposium: Lt. Col. Jesse W. Webb, Directorate of Food Service, DoD.

0910 Menu Planning, an Overview: John Casbergue, School of Allied Medical Sciences, Ohio State University.

1010 Rations, Menus and Food Plans - Requirements and Restrictions: Miss Marion Bollman, U.S. Army Food Service Center.

1045 Coffee Break.

1100 Air Force Developments - EDP Computation of Annual Food Plan from Master Menu: Mrs. G.G. Gotschall, Air Force Service Office.

1130 Army Developments - EDP Computation of Monthly Requirements, Nutritive Value and Costs from Master Menu: Miss Marion Bollman, U.S. Army Food Service Center.

1200 Lunch: Recreation Center.

1315 Developments and Plans for Hospitals - EDP Procedures for Menu Expansion and Ingredient Control: Capt. J.F. Sager, Walter Reed General Hospital.

1345 Veterans Administration Developments - Linear Programming for Dietetics: Miss Helen M. Brisbane, Dept. of Data Management, Veteran's Administration.

1415 Developments for Hotels and Institutions: Charles Sayles, School of Hotel Administration, Cornell University.

1500 Coffee Break.

1515 Working Session A: Input Requirements and Restraints.

1630 Recess until 0900 5 April.

1800 Bus Leaves for Statler Hilton Hotel.

Wednesday, 5 April 1967

0745 Bus Leaves Motor Entrance, Statler Hilton Hotel, Boston.

Room D-133

0900 Working Session B: User Needs, Special Requirements.

1030 Working Session C: Data Availability and Reliability.

1200 Lunch: Recreation Center.

1300 Working Session D: Communications and Compatibility.

1430 Working Session E: Systems Modeling.

1530 Bus Leaves for Statler Hilton Hotel.

ATTENDANCE LIST

Conference on Computer Use in Menu Planning

U.S. Army Natick Laboratories
Natick, Massachusetts

4-5 April 1967

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V. SUMMARY

This study has shown that much work is being done on the use of computers in the areas of menu-planning and food service. A number of different groups are attacking the problem from a variety of directions and their emphasis varies quite significantly. A number of these efforts are related in that they are based on the same starting point, though they differ in their goals. Since the various approaches are attempting to solve essentially different problems and are therefore limited by different boundary conditions and different objectives, the work is not all compatible.

Some of the efforts surveyed are concerned more with the research aspects of menu-planning and have prime interest in the development of techniques and new computer procedures in this field. On the other hand, some are more concerned with the day-to-day planning effort and are in a much more production oriented environment. Because of these variances, it is to be expected that the boundary conditions and criteria selected for each of the efforts under way will vary greatly, and it becomes difficult to assess the applicability of some of these areas because of this. However, the particular projects have been analyzed to determine the techniques and methods used independent of the specific problem at hand, and these methods have been isolated to determine their applicability to the overall mass feeding of the military service.

The type of computing equipment has also varied greatly: from timesharing systems using remote terminals, to simpler computers composed mainly of the computing element with a card viewer and line printer. No clearcut choice can be made on the type of equipment to use since this will vary greatly with the particular project in hand and with the available facilities. One point must be kept in mind in this and similar studies, and this is that the computer is a means for performing a task and not an end in itself. The important part of all these projects is the development of techniques and methods. Though it is realized that many of the approaches used inherently require the use of a high-speed computing facility, the evaluation of the techniques should be independent of that facility. If the technique is good it may require a computer to implement it, but if the technique is bad, the use of a computer does not change its basic nature. Though much of what has been said revolves around the use of computers, this has been mainly a convenience, and the discussions were actually concerned with the concepts involved.

It is evident that there are developments on the way which will apply to all phases of a food service information system. Though not all of the on-going development can be directly applied to such a system, the basic concepts involved rather than the specific techniques implemented may be quite usable in any overall system to be designed.

In studying the overall approach to the food service problem, no major technology gaps have been isolated. To the depth at which this investigation has been conducted, there are sufficient techniques, methods and equipment available to implement most any system that would be designed. This is not meant to infer that the work to date is completed, but rather that an extrapolation and continuation of this work will probably suffice. There are still many unsolved problems and many criteria to be isolated along with much data to be gathered. Similarly, the computing equipment that would be desired can be obtained from that commercially available presently, though it is recognized that due to cost and other factors, it is not necessarily the optimum solution. It is hoped that with continuing development in all areas, both the techniques and the hardware will continue to improve and be sufficient for any future work.

In determining the course of action to follow for the near future, it is of prime importance to establish goals. If the decision is made to attempt to improve the functioning of any local organization i.e., sub-optimization, then the overall effect on a system will have a certain boundary. However, if it is decided that the entire food service system needs examination or review, then the potential for increased flexibility is much greater.

In order to provide the greatest benefits to the entire system rather than to a single function within it, it will be necessary to obtain an overview of the entire operation from food planning to local service. Once this has been performed, it may appear evident that changes are required in procedures at various levels or that the entire system may remain unchanged. In any case, after the overall picture has been obtained, it will be possible to select portions of any generalized system for implementation with a view to the ultimate integration of all components. We are not proposing that an entire system be designed to be implemented in one effort, but rather that the entire system be viewed when designing any portion, so that as the later sections are added, no desirable features will have been precluded by bounds built into the earlier stages.

The potential for the use of new techniques, methods and computer equipment in a food service information system has barely been touched and portends great things for the future. Computers are new devices which require a complete rethinking of approaches since they can serve as an extension of man's intellect and provide much greater power and flexibility than has previously been available. Though they are not a panacea and do not replace humans, they are excellent devices for extending human abilities and allowing people to perform their duties without unnecessary restrictions due to tedious effort.

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13. ABSTRACT

A survey of present status of computerized menu planning accomplishments and research showed that no computerized menu planning system now exists in any military service, and there are no present plans to develop one.

The U. S. Navy and Marine Corps have no accomplishments in computerization of food service which would have a bearing on the development of a system.

Both U. S. Army and Air Force accomplishments are in the area of Food Plan recapitulation and nutrient content and costing verification. These are fully compatible with the system model proposed.

The Food Service Division, Walter Reed General Hospital, is conducting research on a comprehensive food service system of which menu planning is a minor and final part. Although specific for hospital use, parts of the system may be useful for a general troop feeding system.

The Veterans administration computerized procedure, which develops a 28-day Food Plan from which dietitians manually construct menus, may provide guidance for a DoD system.

Accomplishments and research in university hospitals are not directly applicable

(Continued)

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Systems	8,9					
Military facilities	4,9					
Hospitals	4,9					
Universities	4,9					
Computers	10					
Mathematical models	10					

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13. ABSTRACT (Continued)

to military feeding. They are directed toward a demand-based stochastic system, whereas the military services use a plan-based deterministic system.

The Food Plan precedes and is more important than the menu. The Food Plan changes relatively slowly, and much of the clerical routine is now computerized. A model food service system has been presented which includes a Planning subsystem and a Service subsystem and which interfaces with a Supply system. Implementation of this system would result in a "Continuous Food Plan" which could materially shorten lead time in the present food cycle. Optimization of the Planning subsystem requires research to codify and evaluate color, texture and preference factors and the combinatorial effects of these with other factors; evaluate frequency limit restraints; investigate mathematical models which may be better than linear programming; and develop improved computer "learning models" to capitalize on man-machine interactions.